Rock Products
With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Volume XXXV | Chicago, December 31, 1932 | Number 25

How to Be Prosperous!

Not Original! You Said Them Yourselves in Your Suggestions to the Editor

1. Face realities.
2. Get out of debt.
3. Stop bellyaching.
4. Don't wait for someone else to start spending, spend some yourself.
5. Put plant and organization in shape to produce what you can sell, efficiently and economically.
6. Stop worrying about European debts; let President and Congress do that.
7. Stop depending upon Uncle Sam to solve your problems for you.
8. Don't grow gray contemplating the horrors of technocracy—the machine monster that is depriving men of work.
9. Look around you; you will find there is plenty of work left to be done to make this country an ideal place to live in.
10. And remember the old adage, ***"Where there is the will there is a way."***

REALITIES—Things are what we make them; if production and prices are down, face the fact, and start from scratch; don't kid yourself that anyone but yourself and everyone else working together can change the situation.

DEBT—The first step in getting out of debt is to stop going further into debt; that means no matter how little you sell, sell that little at a profit; never mind the other fellow; if he has any sense he'll follow your example; if he hasn't, he'll soon eliminate himself.

Old debts, too burdensome to carry, must be gotten rid of (1) by bankruptcies or receiverships; (2) by scaling them down with the consent of the creditors; (3) by consolidations with stronger organizations; (4) by deflating the dollar. The safest and best way to deflate the dollar is an expansion of business and credit, which will increase the velocity of turnover; that does not require legislation—merely the combined will and efforts of all of us.

BELLYACHING—Won't bring back the "good old times"; your employes, every one who has a boss, looks to that boss for help, advice and encouragement; if present management can't tackle the problem cheerfully and hopefully, there'll be new managements; the underdog can't be expected to wait forever for buoyant leadership—leadership, you know, has to be buoyant to stay on top.

REHABILITATION—If you can't operate an oversize plant efficiently or economically, tear it apart and make it what it should be to produce what you want as cheaply as possible; you never will again, in your lifetime, be able to do it for as little capital outlay as now.

UNCLE SAM—Moves slowly and makes many blunders; the government can make legislation and provide popular leadership—help make measures and methods popular, or acceptable to the public—but it is business itself that must provide business leadership or initiative.

WORK—Do you think for a minute that city streets do not need repaving; or that we have reached the limit of country highway improvement; removed all the city slum areas; provided the people with the kind of housing they really want, or provided a thousand and one facilities for the health, comfort, and enjoyment of mankind that can be provided? There will always be plenty of work for those with the will to work; there will always be capital to invest by those with the will and intelligence to provide it.

Undoubtedly, we shall emerge from this experience with a knowledge that it requires less drudgery to provide the bare necessities of life; but we shall also re-learn that there is no substitute for individual work and industry to provide the real satisfactions of life; for brains, like muscle, develop and are kept healthy by use—there is plenty of use for them today.

What Rock Products Producers Think About Their Prospects

"One fire burns out another's burning,
One pain is lessened by another's anguish."
—William Shakespeare.

TAKE a flying trip with the editor; time, late November, soon after the election; purpose, to sound out business sentiment; the effects of the election, if any. The trip includes practically every state. The conclusion (given to you in advance) is that what business needs most is a good dose of castor oil. The "system" needs a thorough cleaning out. If psychology is a factor in a return of confidence and prosperity, we all need, first, a more cheerful perspective—witness:

NEW ENGLAND

Business sentiment in the cement industry has improved somewhat, probably on account of better prices, but no increase in consumption is in evidence. Of the score of New England producers "interviewed," including producers of cement, lime, sand, gravel, crushed stone, feldspar, slate and talc, 11 find business sentiment bad or indifferent; two, good; three, hopeful; the others are more explicit. The lime industry seems divided into two camps; one overcome by high overhead is apathetically waiting a return of higher prices; the other is cutting wages, salaries, overhead, etc., to the bone in an endeavor to make a profit at present prices and volume, which is nearly nothing. The crushed stone industry, generally speaking, seems to look for another year of low prices and little if any increase in tonnage over the present year, which was the lowest in 20 years.

With the exception of four producers, the opinion is that the presidential election had little or no effect on returning confidence. One despairing producer says: "A definite decision is always helpful, but confidence in what?" Another says the results of the election "retarded confidence on the part of men who have money; the less intelligent gained confidence, subject to some corroding doubts." Another optimist believes "business recovery has been set back six months, but not permanently."

NEW YORK, NEW JERSEY AND DELAWARE

We'll pass on to New York State, home of President-Elect Roosevelt. With cement manufacturers we find sentiment good, or hopeful, with one exception; one says hopeful without assurance; another optimistic as to stabilization of market price but rather pessimistic as to prospects for any increase in volume. Estimates for next year range from no change over 1932 to 10% more. Business sentiment is described by crushed stone producers, good and bad—equally divided, governed apparently by local considerations. Sand and gravel producers find sentiment universally bad, although one sees signs of hope, and one finds it improving. The election result apparently made little difference in sentiment. One producer says it is too early to say, but he has remarked many people stating "everything is going to be all right"; some of this from people who predicted dire results.

A man in close touch with the building industry in New York City finds business sentiment in a state of disillusionment; no building work in sight; men talking radical change in financial structure—all the more surprising because a few years ago these same men were ultra-conservative; now talk "a new deal." The same observer thinks executives of large industry were "Hoover-minded" and naturally were disappointed; he believes there has been too much tendency to look to Washington for business helps.

In New Jersey, sand, gravel and crushed stone producers, with one exception, find sentiment bad or indifferent; the one, hopeful. As in many other states, taxpayers are behind on payments and there is little or no indication of raising funds for public improvements. In the feldspar industry a prominent producer finds business sentiment good. Silica producers see an improvement since mid-summer, but still spotty—one month good, the next bad.

An engineer in Delaware, familiar with all rock products industries, finds a hesitant feeling of uncertainty; no great spurt is expected, although a gradual betterment is the only movement possible, apparently.

SOUTH ATLANTIC STATES

Crossing the Mason and Dixon line into the Democratic South, we find little change in business sentiment; even here the majority opinion is that the results of the election were not a factor in returning confidence. In Virginia, probably because of efforts to keep up highway work, business sentiment is better than farther south. In Georgia, for example, sentiment is described decidedly downcast, influenced by low prices of farm products, particularly cotton. Georgia crushed stone producers find much larger plant capacity than market can absorb for many years. Florida sand, gravel and stone producers are hopeful, but see little prospect of either commercial or highway business in 1933. Only phosphate producers are happy; production is ahead of last year, and it can be assumed present output is about normal.

PENNSYLVANIA

Some 40 producers were "interviewed." Roadbuilding—mostly of a simple kind—has been maintained on a fairly large scale up to the present time; gasoline and automobile license taxes have been saved for use on highway construction through the raising of funds for unemployment relief by other methods, more particularly by a general sales tax.

Business sentiment, seen by a number of cement industry executives, is described as both good and bad—about equally divided. The recent increases in prices have undoubtedly added hope, if not optimism. One outstanding executive expressed it: "Company executives are resigned to the realization that restoration of normalcy in the cement industry is still in the dim distant future," but they are resolved to adopt business methods that apparently will insure survival. That attitude could well be adopted by rock products producers everywhere.

Crushed stone producers describe business sentiment in all shades from bad to good. One says in spite of the fact that 1932 was the worst year of his experience, sentiment is surprisingly good, for producers seem to think conditions cannot be worse and any change must be for the better. Sand and gravel producers are in much the same state of mind. Two see hopeful signs and believe sentiment is improving. One makes the interesting observation that "the older concerns and individuals are licked; but the younger ones are fighting and showing initiative—not waiting for Tom, Dick and Harry to start something"—an observation that should get some attention. Sentiment in the lime industry is inclined to be hopeful. Of three silica producers "interviewed," one finds sentiment bad, one very bad, with every one adopting a waiting attitude before becoming alarmed; the third finds sentiment fair. A prominent slag producer says "no one is expecting disaster—only concerned as to the date of return to normal." A slate producer finds the outlook bad.

Comments on the election results are various. One silica producer sees hope for the

glass industry in a change of the prohibition laws; a stone producer sees the "man on the street" with more confidence; another, "at least the funeral is over; confidence must return"; another, "even the most dyed-in the wool Republicans are now saying that perhaps a change will do good." A cement manufacturer observes: "Every one says the election was so decisive it should help, if any thing can; it is still left wholly 'up to the other fellow'"; another, "perhaps business is retarded temporarily but it will improve for the long pull"; two others express fear that the tariff will be tampered with. A sand and gravel producer remarks: "Even in Pennsylvania a common sense attitude is taken."

EAST CENTRAL STATES

An Ohio cement manufacturer finds "the tone of business sentiment better—the price war, so-called, has brought many manufacturers down to earth; their balance sheets evidently caused this; 1933 looks more hopeful than 1930, 1931 or 1932." Crushed stone producers find sentiment bad or indifferent, without exception. Sand and gravel producers are somewhat more optimistic, although two vision the end of road building in their own localities. Another finds present sentiment fair and hopeful and believes improvement already started; he does not look for any worse conditions. A lime manufacturer describes conditions as 20 to 25% normal, with prices badly demoralized because of unethical competition. An engineer closely allied with the sand and gravel industry finds during the last month a desire to stabilize prices and to make the small amount of business available, profitable—a sentiment that producers everywhere should adopt, pronto!

A Michigan sand-lime brick producer believes the next six months will show decided improvement. A cement manufacturer says sentiment is hopeful rather than optimistic. The majority opinion in the sand and gravel industry is hopeful, expecting business to pick up in the spring, although there seems no real basis for the belief. One expects business to be very quiet for at least two years more. Indiana sand, gravel and crushed stone producers find sentiment bad or indifferent, with highway programs except state highway work cut to a minimum.

In all three of these states the results of the election are generally held to have small influence for better or for worse. As elsewhere, there seems to be considerable belief that employers are less hopeful than labor, and consequently inclined to adopt a "waiting" policy.

THE CORN BELT STATES

Business sentiment in Illinois is described by numerous sand, gravel and crushed stone producers in a variety of terms—due probably to the complete turnover in state politics and the very uncertain future of highway construction. One stone producer describes sentiment as worse than bad—"all working to find a market along old lines, and to promote new uses." A sand and gravel producer says the outlook for building construction is bad, indifferent for road construction; another sagely observes "sentiment good with the live wires—those able to adjust their operations to present conditions—bad with the rest." A lime manufacturer finds sentiment good, "most people believe business should pick up, for it has been about as low as could be; inventories are low and will have to be built up." A gypsum manufacturer is hopeful; another says it "is calm—with a tinge of optimism." A man closely identified with the silica industry finds sentiment based on the "peak years," bad; based on a series of average years, good.

In Iowa, the most important agricultural state, sentiment is universally bad—a reflection of the downcast outlook for agriculture. An engineer in close touch with the aggregate industries observes that plants have subsisted largely on highway work and the prospects are there will be little such work the next few years. A stone producer describes business at a standstill because of the political upset and so many new men taking over the state offices; however, the same man expresses the opinion that the result of the election in general was to accelerate returning confidence because "a large number of people who have money to spend were afraid of the present administration and were conserving their cash." A sand and gravel producer who finds business sentiment "quite good" says the election results will retard confidence, now at very low ebb, and cause "much slow stepping."

A Missouri sand and gravel producer finds the outlook for state highway work good, but bad for general building. Another comment says business sentiment is reconciled to conditions and not so nervous; "more willing to wait return of normal times, but not the 'normal times of 1929-30'." A lime producer says: "It seems impossible to reconcile two prevailing policies, 'mass production' and that of 'live and let live,' consequently 'the law of the jungle' will govern."

The results of the election, according to the majority of opinion in these three states, will have little effect; otherwise opinions are about equally divided. One sand and gravel producer remarks, "believe the election results will accelerate returning confidence up to the time some major 'bull' is made, which to a Republican mind is inevitable."

CENTRAL NORTHWEST

Before going South again we'll look into conditions in Wisconsin, Minnesota and the Dakotas. In Wisconsin aggregate producers report sentiment good, fair, hopeful, bad and indifferent, but with one exception they all feel that the election accelerated returning confidence. Lime manufacturers feel the same. A Minnesota crushed stone producer finds retail business bad but wholesale business in general commodities shows a nice improvement; in his particular business conditions continue bad; a sand and gravel producer finds sentiment good, with a general feeling that business is going to get better, with nothing to substantiate this feeling but hope. One of these producers thinks that the election slowed up the beginning of a marked improvement; the other believes returning confidence will be accelerated. Producers in the Dakotas find business sentiment indifferent.

LOWER MISSISSIPPI VALLEY

As we go South down the Mississippi Valley, "calling on" producers on both sides of the river, we find business sentiment improving until we reach Louisiana, where an extravagant state administration is said to have ruined the possibility of highway construction in the near future. A Tennessee cement manufacturer sees a better feeling as to the future now becoming evident; another says business sentiment is showing a somewhat better, more hopeful spirit, but with nothing much to justify it so far. A sand and gravel producer reports that sentiment is good in the sense of being very hopeful. A Mississippi producer hopes for better conditions in February or March—not much before.

An Alabama producer of tripoli finds sentiment bad on account of the condition of the steel industry, but sentiment has improved in recent months and prospects are better.

With few exceptions producers in these states believe the election results helped materially to restore confidence. Here are a few of the comments: "Election cleared the atmosphere and removed one hindrance; at least we are relieved of destructive criticism, may now expect united and constructive action at Washington"; "to extent that confidence is entertained for farm relief measures and that something may be done about Muscle Shoals, the election helped."

SOUTHWEST

Nebraska aggregate producers report little business save a few postoffice jobs and a little road graveling. In Kansas, sentiment is described as indifferent rather than bad; other comments in this state are: "There is a feeling of encouragement"; "sentiment is outwardly optimistic, but the basis seems to be 'this can't go on forever,' or else 'it won't do for this to get you down'"; "banks and mortgage companies fear inflation; producers and public relieved by the election results because they hope for a change, but fear they won't get it"; "on the part of laboring classes the election made for returning confidence; however, those who give the situation more thought are doubtful." Most Nebraska producers evidently subscribe to a report something like this: "The election had little effect; we do not think Con-

gress is going to be able to do very much for general business revival."

Arkansas producers are fairly optimistic owing to the help given their state highway department by the R. F. C. An Oklahoma producer finds sentiment indifferent, commenting on the election says: "A revolution of ballots is much better than a revolution of bullets." Another describes business sentiment as not good, bad or indifferent, but alert and hopeful; he sees an immense amount of impending repair work when customers get money, regardless of new construction. The same producer commenting on the election states: "Confidence is gradually returning, people are not panicky; they hold a powerful club over political leaders, have demonstrated its effective use, so that new officers are going to make a desperate effort to straighten things out."

In Texas we find almost everywhere the expression that sentiment is improving; while prospects for railway ballast, general building and agricultural products are poor, the prospects for highway construction are good. Most of the Texas producers believe the results of the election will accelerate returning confidence.

ROCKY MOUNTAIN STATES

Colorado producers are evenly divided as to whether business sentiment is good or bad. They can't see that the election had any effect, one way or the other. In Nevada sentiment is said to have improved over the summer low. A Utah producer finds business "30% normal" and too much cut-throat competition. In Montana sentiment is reported bad, with one exception who finds it hopeful, with no large jobs in sight, but a forecast of slightly better business in 1933 than in 1932. Producers here see the election as of no influence at all. Wyoming producers are unanimous in describing sentiment as indifferent.

PACIFIC COAST STATES

California exhibits a wide variety of opinions, a few of which are quoted: "Business sentiment reserved—very poor—looks better for spring"; "sentiment on the whole is hopeful, but still on the waiting list; what business is in sight would be for next year (1933)"; "general business more optimistic since election"; "agricultural conditions bad—in spite of discouraging conditions, business sentiment is courageous and determined to climb out"; "general sentiment good, but stimulated by hope rather than by current business; building far below normal." The feeling in regard to the results of the election is equally various.

In Oregon and Washington we find a very similar condition. Here the possibility of tampering with the lumber tariff is a disturbing element.

CONCLUSIONS

Perhaps the reader will think little is gained by publishing such a doleful recital, although we believe it is an excellent example of a cross-section of the present mind of the American people as a whole. We think that sometimes a frank, unvarnished presentation of ourselves by ourselves makes us ashamed of our lack of faith, and resolves us to start out anew. We see ourselves still looking back on "the old days," refusing to recognize that times and conditions have changed radically. The following suggestion from a young man, who admits little experience, may be more sound than absurd or insulting: "Give a one year's moratorium on conservatism and 'let's play safe attitude'—take Dr. Osler's advice to a degree, place the older executives on a pension, too many 'stuffed shirts' among them anyway; they have had easy sailing, and when faced with the present storm they wish to scuttle the ship. But, dropping metaphors, the young man still has faith, although not in stuffed shirts; the grass still looks green to us, and we are proud of it; although the older executives look on this attitude pityingly as a sign of adolescence."

Credit Conditions Reported by Producers

SOME 250 producers in all parts of the country report credit conditions as of November 15-December 1. All except 48 see no improvement during the past few months. Any results of the operations of the R. F. C. have not filtered through to them. As a Connecticut stone producer remarks, "if one fulfilled the requirements for a loan through the channels of the R. F. C. he would not need aid."

The 48 who see improvement, or who have had no credit troubles, are widely distributed, and their favorable condition is due either to strictly local factors, or to a very limited business or a specialty business with a few steady customers.

There seems to be quite a section of Pennsylvania where credit conditions are better than elsewhere, for some reason or other, perhaps on account of highway construction. Virginia shows some evidence of having better credit conditions. Wisconsin is another state where several producers find conditions better. A number of producers in the state of Washington report no extreme credit problems and an improvement recently.

HOW TO EXPAND CREDIT

Of course the universal complaint is tightness on the part of banks and bankers. Bankers in some of the big cities are urging the greater use of trade acceptances. From a banker's point of view they are one of the most favored kinds of commercial paper, because a trade acceptance is "a two-name paper" and the bank is thus well protected. It is claimed that the wider use of trade acceptances would free some of the idle mony in banks and help business.

Rock Products has already published considerable about trade acceptances, what they are, their advantages to industry, and the proposal of the Associated General Contractors of America to encourage their use, hoping thus to eliminate the irresponsible contractor. It is quite evident from the reports of several hundred representative producers that very few know how to use trade acceptances.

TRADE ACCEPTANCES

It seems the best way to treat comment on trade acceptances is geographically. They are applicable to all rock products industries. Their successful use depends on the cooperation of three parties, the producer, the buyer and the banker. Ignorance, misuse and other reasons on the part of any one of these may keep trade acceptances from being more widely used. Our questionnaire was somewhat faulty in that it did not provide for an explanation of why many are prejudiced against the use of trade acceptances. Some comments give reasons.

No instance where trade acceptances were being used was discovered in New England; 13 of 17 producers are unfamiliar with their use. Of those who are, one agricultural limestone producer says "they are N.G." A stone producer states: "Trade acceptances are not likely to make any difference in this industry in this locality." A Massachusetts sand and gravel producer says: "Have studied the use of trade acceptances more or less; don't think they would help."

As might be expected, New York State producers are more familiar with the use of trade acceptances, 14 against 4 who are not. Of the four who have not studied their use, two are already convinced they will not help expand credit in this industry. Of the 14 who have studied their use, five do not believe their use will help the situation. Reasons are, "do not take in this locality"; "don't hold the appeal they once did"; "not generally applicable to the cement industry because of cash discount and other trade practices"; "not practical because of 6% discount." That leaves six who are familiar with the use of trade acceptances and who know they will help; one says, "of material help when buying starts"; another, "may have limited use; this company will use them as conditions warrant"; another, "they will help to some extent."

Only two of seven New Jersey producers see any virtue in trade acceptances. One already uses them and finds them helpful; the other thinks they "might help some."

In Pennsylvania, 13 of 30 producers admit no knowledge of the use of trade acceptances. Of the 17 who have used them or know about their use, six are convinced, unqualifiedly, that they won't help. Five give various reasons why they will not help: "In our opinion the theory of the trade acceptance is incompatible with the long established principle of the cash discount and therefore will not be adopted by the cement industry"; another cement executive remarks, "trade acceptances are not 'for these times,' for trade acceptances must be met; notes can be renewed"; a lime manufacturer, "trade acceptances will not help, no assurance they can be paid when due"; a stone producer, "trade acceptances nothing more than promissory notes"; a silica producer says his local banks would not take trade acceptances. Six Pennsylvania producers have used trade acceptances, or are familiar with their use, and are sure they are helpful in meeting stringent credit conditions.

SOUTH ATLANTIC STATES

In the South Atlantic States from Delaware on, 20 producers reported on trade acceptances; 11 are unfamiliar with their use; of the nine who are familiar with them, two do not think they will help; the others comment as follows: "will help"; "have not made use of them; if adopted, would help"; "think they would help"; "have used trade acceptances and find them satisfactory and very convenient; believe they will help; many do not understand their use"; "have used trade acceptances to a certain extent; doubt if they will help the industry as a whole"; "have used trade acceptances very little; however, where we have used them they have been promptly paid."

SOUTH CENTRAL STATES

Of 13 producers in Alabama, Louisiana, Tennessee and Kentucky, nine are unfamiliar with the use of trade acceptances, a few *think* they would prove helpful; the others, for no reason at all, think otherwise. Of the other four, one says he has used trade acceptances only a little; another, "have used trade acceptances for many years, but have never seen much advantage in them; they probably would help credit conditions to a slight extent"; "believe trade acceptances would be an aid"; "trade acceptances would help but they are not in general use."

OHIO, MICHIGAN AND INDIANA

Thirty-seven producers reported on trade acceptances as follows: 24 are inexperienced, a few of these are inclined to believe they would help; the 13 who have studied their use, or have used them, comment thus: "will help"; "will help materially"; "are not established"; "tried and not proved successful"; "our experience with them has not been satisfactory"; "do not use trade acceptances, but they are an aid to business recovery"; "trade acceptances are not generally used and therefore would not be acceptable to the trade"; "if properly used believe they will help industry"; "can't see where the industry would be benefited"; "doubtful if they will help"; "trade acceptances will not have any effect in this industry—markets too limited"; "little experience with them, but believe they would help"; "use trade acceptances, but this tool is entirely inadequate to help much."

ILLINOIS, IOWA, WISCONSIN

Of this group of producers, 21 are unfamiliar with the use of trade acceptances, most of them already prejudiced against them; 11 have studied their use, or have used them; some of their comments are: "believe trade acceptance a good form of settlement; they will surely help"; "not widely used"; "doubtful if they will help"; "will not help"; "about 1915 or '16, endeavored to stimulate the use of trade acceptances, but found customers either uninterested or insisted on using them in way for which they were not designed, such as taking care of past-due accounts and to replace ordinary notes"; "have studied trade acceptances and use them to some extent, both taking and giving; not a particularly attractive form of settlement because we buy so little that cannot be taken care of for cash when due; do not think they will make any particular difference to rock products industries"; "hard to tell if they would help"; "believe they would help"; "trade acceptances are OK and will help"; "believe trade acceptances a lot of humbug because they lend themselves to unscrupulous use; build up credit on your books which you can discount at a bank and then worry how to pay them yourself when the other fellow does not"; "won't help—merely a device to extend credit further."

NORTH DAKOTA TO TEXAS

In the tier of states from North Dakota to Texas are 31 reporting producers; 20 are unfamiliar with the use of trade acceptances; a few of these are already convinced they could not be helpful; some of the comments of the remaining 11 follow: "have used trade acceptances for several years; they will help the recovery of this industry"; "have studied their use, they will help"; "trade acceptances of little use if ultimate debtor has neither funds nor credit; even our state highway commission has anticipated revenue and banks refuse its paper"; "will not help"; "trade acceptances fine for an industry doing a *steady* business, regardless of how much it is doing"; "will not help"; "doubtful if they will help"; "the short time limit is against their use in many instances"; "find trade acceptances impractical, due to high discount charges"; "general use would probably help, but can't see where they would materially affect our industry as a whole"; "trade acceptances are helpful."

Nine producers in Montana, Utah, Wyoming, Colorado and Nevada report. Four are not acquainted with the use of trade acceptances; five are, and they comment thus: "don't feel trade acceptances will help"; "except in rare instances would not help"; "won't help"; "may be of some benefit"; "bulk of our business is handled satisfactorily on open account"; "trade acceptances are useful in some instances but certainly not a cure-all."

PACIFIC COAST

Eleven producers in California, Oregon and Washington report they are not familiar with the use of trade acceptances; ten are, and comment: "have studied their use; not prepared to say if they will help"; "they will help"; "occasionally use trade acceptances; would not help increase the volume of business or prices; both need a boost"; "their use will not help until there is an appreciable volume of business"; "prefer bankable notes"; "believe use of trade acceptances will be beneficial to industry generally"; "use them now"; "cannot use them to any extent in sand and gravel business"; "credit conditions good, no need for trade acceptances"; "hardly think they will help."

SUMMARY

Apparently about two-thirds of the producers of rock products know nothing about the use of trade acceptances. Of these, half are blindly prejudiced against their use.

The great need of banks today is eligible commercial paper. The great need of the country is an expansion of credit. Bankers say trade acceptances are one answer.

One successful producer friend has told the editor he got his start in the aggregate business by the use of trade acceptances. They furnished the only working capital he had for a number of years. Most businesses today need working capital above all else.

If the reader has analyzed the objections quoted in the foregoing he will find very few valid ones. Most of them seem to be based on objections to disturbing the long-time, indefinite trade terms now in use, which makes it almost impossible for producers and manufacturers to raise cash on receivables. Trade acceptances are of course designed to eliminate just such bad business practice. The only valid objection seems to be the general ignorance of the trade, and lack of cooperation of buyers and banks.

It seems to us that the results of our investigation demonstrate better than anything else the almost universal lethargy that business men have allowed themselves to fall into. It would be better if they showed more interest in *any* measure that might help to expand our shrinking credit structure and thus help business, even though they can see no direct benefit at the moment to their particular business.

A Perspective of Rock Products Industries*

By Paul Hatmaker
Building Materials Section, U. S. Bureau of Mines

NOW that optimism is gaining currency, it is of interest to review some typical nonmetallic industries, particularly their growth and past relationship to general business. By placing certain historical data in proper perspective, such a review may be of assistance in interpreting future events. Prophecy, however, is beyond the scope of the present discussion.

Cement, lime, sand, gravel and crushed stone, among the major nonmetallic products, are the subject of this analysis. Comparisons are made of tonnage, or quantity produced, and average unit value, or, broadly speaking, price. To facilitate comparisons, the actual units of statistical measurement—barrels, tons, and dollars—have been reduced to index numbers. Data for a single year are taken for a base represented by 100. Data for other years are calculated in per cent. of the base year.

For example, a particular industry may have produced three million tons in 1926. If 1926 is taken as a fairly normal year and is to be used as a base, the index number for 1926 is 100. If two and one-half million tons were produced in 1925 and three and one-half millions in 1927, the corresponding index numbers will be 83 for 1925 and 117 for 1927, neglecting fractions. By this common device of the statisticians an industry producing millions of tons a year can be compared readily with one producing thousands of tons without obscuring trends and relationships by great differences in relative magnitude. Similarly, prices may be reduced to a 1926 base and price movements in turn may be contrasted with increases or decreases in volume of production.

Production indexes calculated from Bureau of Mines statistics of cement, lime, crushed stone, and sand and gravel are shown in Fig. 1, together with an index of general industrial activity computed from data gathered by the Standard Statistics Co. Inc.

Price indexes are shown in Fig. 2. Behavior of prices in general is reflected in the curve for all commodities, which represents a composite average computed by the Bureau of Labor Statistics from wholesale prices of a large number of commodities. Price indexes of cement, lime, sand and gravel, and crushed stone, calculated from Bureau of Mines data (representing average unit value as reported by producers f.o.b. mines or quarries) lie within the shaded area, and the weighted composite production index of these materials is shown by the dotted line to bring out the striking differences in past behavior between production and price curves.

Fig. 3 shows this composite index of nonmetallic production plotted against indexes of highway mileage (from data by the Bureau of Public Roads), motor vehicle production (National Automobile Chamber of Commerce and Bureau of Public Roads), and total building and residential contracts awarded (F. W. Dodge Corp.).

Economic readjustments normally come about rather gradually. Buying habits of the public ordinarily do not change drastically enough or rapidly enough to throw our entire industrial machinery out of gear. Great wars, on the other hand, have always disrupted the economic as well as the political lives of nations. The effects may be concealed for many years after the formal termination of hostilities.

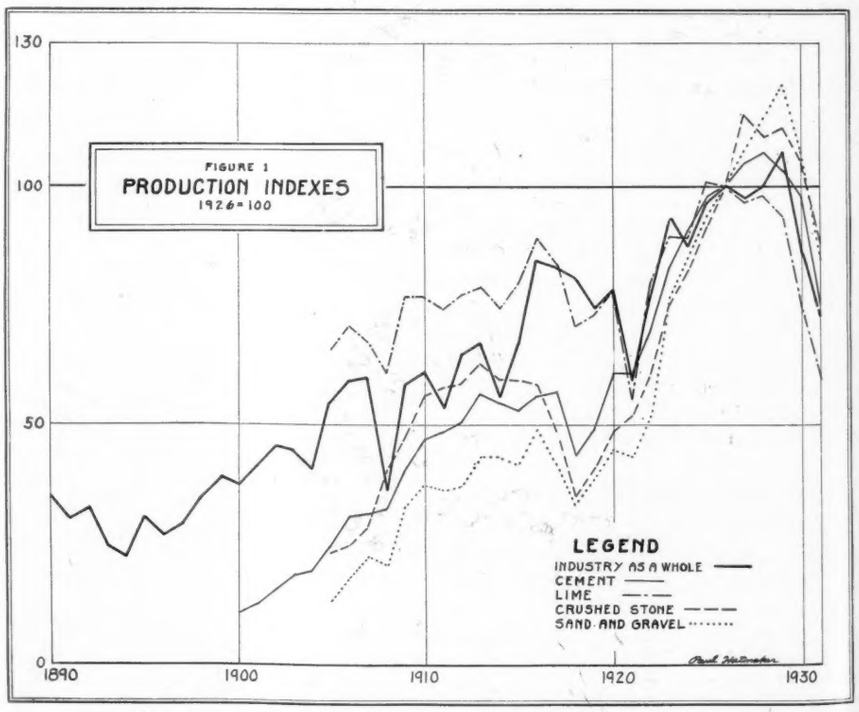
The fundamental forces now at work, however, did not all originate during the World War. During the past 40 years the United States has changed from an essentially agricultural country to one that is highly developed industrially. As late as 1890 the rural population was about 65% of the total, whereas it was only 44% in 1930; the number of people engaged in agriculture decreased from 43 to 22% of those gainfully employed. Advances in the science of agriculture have made it possible for a people to devote their major endeavors to other activities than winning of food supplies.

At the time men were being released from farms, their efficiency was likewise increasing as a result of better machinery and mass production methods. The output of manufactured goods consequently increased much faster than the number of factory workers.

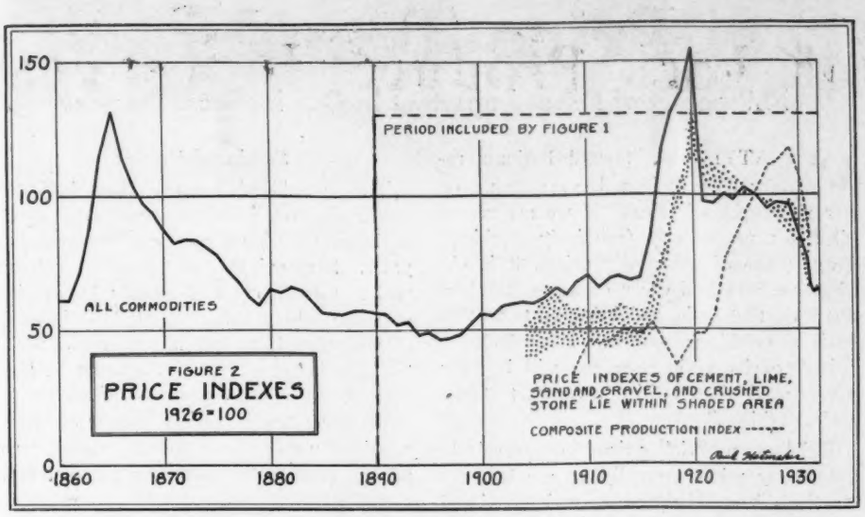
In an amazingly short time vast industries have been founded and new—and rapidly changing—national habits formed. The nonmetallic industries owe their growth mainly to events of the past 25 years. The total

Editor's Note

***THE READER** should keep in mind that the author has arbitrarily chosen 1926 as a "normal" year, or for his index of 100. In the editor's estimation 1926 may prove to have been more than a normal year. Had the average of the 10 years 1923 to 1932 been picked as normal the base line would have been considerably lowered. However, for comparative purposes the selection of the "normal" base is not really important. One man's guess of "normal" production and prices is as good as another's.—The Editor.*



*Published by permission of the Director, U. S. Bureau of Mines. (Not subject to copyright.)



production of the nonmetals under discussion had more than doubled between 1920 and 1929, as shown by Fig. 3.

Hard roads—made necessary largely by a transportation revolution—have stimulated the sand and gravel, crushed stone, and cement industries. In other nonmetallic fields the internal combustion engine is the underlying cause of increased production of fuller's earth, most of which is used in oil refining; steel manufacture has carried fluorspar with it in its rapid growth, in addition to furnishing an expanding market for fluxing limestone and refractories; and other nonmetals likewise have been affected.

Industry by and large was adapting itself slowly to the changing order when the World War injected new complications. The effect of war disturbance upon price levels is shown in Fig. 2. After the Civil War it took 14 years for prices to regain prewar levels. Another period of 14 years has elapsed since the World War. It may be significant that not until the middle of 1932 had all commodity prices declined from the peak of 1920 to a level conforming to the period from 1897 to 1915 as projected to 1932 without regard to World War inflation.

Also it will be noted that the price pattern of cement, lime, sand and gravel, and crushed stone follows in the main the price curve of all commodities. Falling prices during the past 7 to 10 years have not been isolated problems in individual industries.

Whereas the late war activities inflated prices generally and called for increased production in some industries, the war-time demand for cement, lime, and mineral aggregates was subnormal because construction generally was at a low ebb during the war and production of these nonmetals was not essential to war-time activities.

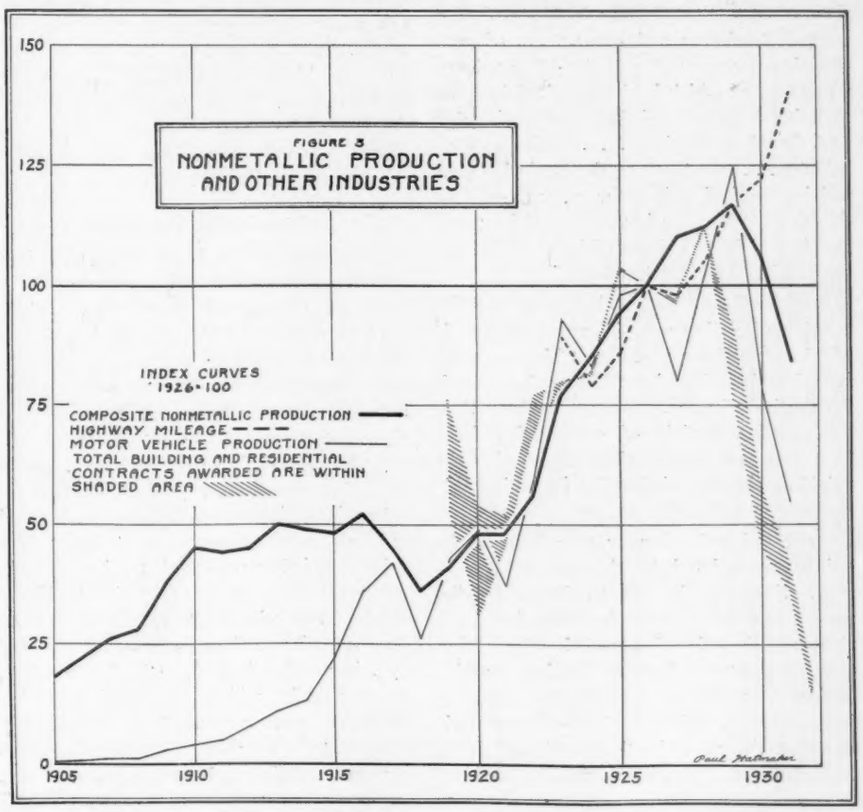
Among conditions other than war affecting business may be mentioned the period of agricultural distress in the mid-nineties. Prices reached low levels and general industrial production likewise slumped. Thereafter, however, business continued an upward trend with only minor setbacks until the panic of 1907. The slump in general business activity in 1908 is shown in Fig. 1. Lime production declined considerably, sand and gravel fell off somewhat, cement barely hesitated in its course, while crushed stone spurted onward. Minor business recessions in 1911 and 1914 had only slight effect upon the major nonmetallic materials.

From 1918 to 1929, as shown by the composite index of the group of nonmetals under consideration, production went up without appreciable setback, despite the depression of 1921, during which occurred drastic price recessions in many commodities, including building materials. Many industries were caught with huge stocks by deflated prices and were badly buffeted during late 1920 and 1921, but recovery beginning early in 1922 was rapid. Building became active (Fig. 3) and general industrial expansion was the order of the day; but prices of building materials, which had recovered slightly from the low point of 1921-1922, began in 1923 a gradual recession that, except for a slight recovery in 1929, has continued virtually until 1932.

Industrial activity declined in 1924, but recovery was hastened by abundance of credit and the fact that a bumper wheat crop was sold for good prices prevailing in the world markets. Building activity continued, however, and the nonmetallic industries prospered despite a decline in highway mileage.

The period 1925 to 1927 was characterized by relatively stable conditions at home and abroad. England, among other countries, returned to the gold standard. A good balance appears to have been maintained between production and consumption in industry as a whole. Commodity prices, after 1921, reached a peak in 1925. The close of this period was marked by what might be termed a business hesitation. Automobile production fell off, but this was attributable to preparation for radical changes in model by one of the largest manufacturers, which involved a considerable period of plant inactivity. The construction industries declined slightly in 1927, but apparently not enough to affect seriously the nonmetallic operators.

During 1928 and much of 1929, industrial expansion was rapid. Speculation in the stock market and in real estate was widespread. By 1929 production was outrunning the purchasing power of the people at the existing price levels, and the breaking point came in the autumn of 1929. Already, how-



even early in 1928 residential building had begun to decline, and total building contracts were receding prior to the collapse in 1929.

No two industries are affected in quite the same way by changes in general business conditions and even in the same industry there are differences in different parts of the country. Nevertheless, without attempting to analyze the complex forces that brought about the ups and downs in production and prices, it may be noted here that the nonmetallic mineral industries, due to their employment in building and other types of construction, are characterized by wide variation between periods of prosperity and periods of depression. Broadly speaking, these industries, like the steel industry, are either prince or pauper—and for much the same reason.

"Capital Goods"

Cement, lime and aggregates can be classed rather broadly as durable materials either because they chiefly enter relatively permanent works or because they are consumed largely in the manufacture of durable goods. In the same category are iron and steel (and consequently iron ore, fluxing stone, and metallurgical coke), nonferrous metals, plate glass, lumber, locomotives, and ships. Opposed to these are nondurable products such as foods, tobacco products, textiles, leather products, paper, petroleum, automobile tires and tubes, and similar products which are affected less by periods of depression, because they must be replaced more or less rapidly and continuously. This relationship was analyzed in the Federal Reserve Bulletin for November, 1932, which stated that whereas "building and other types of construction are examples of durable products, the output of which is characterized by wide variation between periods of prosperity and periods of depression, . . . available data indicate . . . that the long decline in building activity continuing into the early months of the current year has been followed by a period in which the volume of construction has remained steady at a low level."

Low levels of construction mean low demand for building materials; nevertheless it will be noted from Fig. 3 that highway construction since 1928 has done much to check the decline of nonmetallic production. Producers of materials of construction have been more fortunate than some of their neighbors in other industries in having this anchor to windward.

But the low levels now prevailing in the building materials industries cannot last forever. Surpluses in construction soon disappear as a result of obsolescence, deterioration, and loss by fire, and in a growing country a demand for new housing facilities constantly accumulates. Returning prosperity, moreover, adds a further fillip as families feel the urge for improved and more modern homes, as public works.

Price Trends?

Philosophy of Prices Important in Our Business Strategy

OUR ATTITUDE toward business recovery depends in a large measure on our philosophy of prices. If we are reconciled to a permanently (relatively speaking) lower plane of commodity prices, it is obvious we will lend every effort to start out anew on that basis, and bring costs to that basis as quickly as possible. If we look for prices to rise again soon, we will be very apt to mark time, waiting a return to "normal conditions."

Building material prices, compared to commodity prices generally, as a whole are relatively low. If the producer is convinced that his costs are as low as it is possible to get them, there is no alternative but to increase his price. He must from now on have a margin of profit, however small. Numerous cement manufacturers have already announced price increases, in the face of declining production, because they are driven to the point of at least getting back costs or losing their mills. If this policy were universally adopted it is probable the depression would soon be over, for at last a check would be had to continued deflation. But unless such a policy is universally adopted, can the manufacturers of any one commodity stem the tide?

Cement

A majority of cement manufacturers believe, or hope, prices will tend upward. One suggests that it would be best if the price would stabilize at or slightly above the present price; that in general the prices of most commodities are too low, but that the prices of some highly manufactured products are still too high. A few producers look for a further decline, and an equal number state frankly they have no idea what direction future prices will take.

Lime—Crushed Stone

Lime manufacture being more of a local industry than cement, prices are not so uniform and consequently a producer's opinion may be colored by circumstances which do not affect the industry as a whole. Anyhow, more than half the producers reporting are quite positive that prices will advance; only three see a continued downward trend.

Just about half the crushed stone producers reporting believe or hope a price increase is coming, although many qualify their opinions with observations "that present prices are below cost"; "that prices must increase if we are to stay in business"; "higher but will never return to the old level"; "prices as low now as they can get." A fair number look for still lower prices; these are in widely separated localities; about the same number look for prices to remain stationary; and about the same number are unwilling to hazard a guess.

Sand and Gravel

Very considerably more than half the sand and gravel industry, apparently, expects or hopes for higher prices in the next five years. Such opinions as these are common: "prices already cut to bottom"; "must rise, everyone selling below cost"; "the industry cannot stand it to lose money indefinitely"; "upward or we will all go bankrupt." About 10% of the producers expect prices to decline; these are in various localities; about an equal number look for no change from present levels; the remaining few are noncommittal.

Other Rock Products

Enough has been quoted to show the state of mind of the industry regarding price trends. Typical opinions of producers of other rock products are: "Inflation of currency may raise prices, but we can't see where it can increase profits"; "price rise to where a small, but reasonable, profit can be made"; "price tendency will be downward until enough business is available to satisfy the minimum requirements of many plants."

Summary

The majority of rock products producers still place their hope of profit in higher prices for their commodities, being convinced, probably, that costs have been cut to the limit. This may or may not be so; very often the producer himself is not a good judge as to how far his costs can be cut. Taken along with the very general belief that the industry has few if any obsolete plants, the editor is inclined to believe that costs have not touched bottom—although probably manufacturing or production costs are much nearer bottom than some of the other elements of cost.

If price increases are made under present and immediately prospective conditions, of slack demand in the face of large overcapacity of the industries, it requires that practically every producer admit that a price increase is his only salvation; that he refuse to take business on which he cannot turn a profit; that if he cannot get enough business to justify the operation of his plant, that he turn the business over to a competitor who has enough more to justify operation of *his* plant. Obviously these decisions all take moral courage and a broadgage attitude toward business recovery. However, it would seem that they present the only sound course for this or any industry to pursue. The alternative is wholesale receiverships and bankruptcies, with no great ultimate benefit to the survivors so long as the plants of their erstwhile competitors continue to exist, to be operated again, in all probability, with a return to profitable prices.

Increasing Plant Profits

By Earl C. Harsh

THE NATIONAL COMMITTEE on Industrial Rehabilitation, headed by A.W. Robertson, chairman, Westinghouse Electric and Manufacturing Co., Pittsburgh, Penn., has been urging the immediate modernization of equipment and methods in the interests of economy and better business conditions.

The latest publication of the committee, a booklet, "Rehabilitation—What's in It for You," and a check sheet for making a survey of plant conditions and methods, bring out points well worth the consideration of rock products producers. Copies of these may be obtained from the committee headquarters at 435 Seventh Ave., Pittsburgh, Penn. The check sheet lists various items of equipment and is arranged with columns so that the condition of each item and the estimated cost of needed changes may be shown alongside any benefits to be expected from such changes.

Such a survey of the layout and of the methods used and the condition and suitability of each piece of equipment often reveals unsuspected opportunities for profitable rehabilitation. In many cases the checkup is more valuable when made by an outside party because it is easy for the superintendent or manager to become so accustomed to the established order that he does not always see the possibilities.

Often, also, the extent to which profits may be wasted through the use of obsolete equipment or the improper maintenance of good equipment is not always fully realized by those in charge. However, these matters can all be brought out into the open and a proper decision reached after a thorough survey of the whole operation.

Any changes must be based on sound principles and on self-interest. There can be no advantage in changing equipment or methods unless it will reduce costs and increase profits.

Profits may be increased, of course, by reducing the costs of production and distribution or by increasing the selling price, but under present competitive conditions this resolves itself mostly into a matter of lowering the cost of production. This may be done by using more efficient methods and more efficient equipment; but even here the equipment must produce enough cheaper so that the savings will pay for its first cost in a short time, say three or four years, depending on conditions.

In many cases lower production costs may be obtained by giving a little more attention to keeping equipment in proper condition and without resorting to expensive changes. But in most plants a survey or study will show a number of ways in which the operation may be improved. Several of the more important ones are noted below.

Reducing Electric Power Expense

Power bills, if excessive, may be lowered by the reducing of peak demands for power and by improving the load factor. This can be done by making such changes in the operating schedule as will result in a more uniform power demand as against periods of high demand and other periods of lower demand, and by taking measures to prevent peak loads such as result from the starting of a number of motors at the same time. Most power bills are made up of two parts: one part, the demand charge, being based on the maximum demand, and the other part, the energy charge, being based on the actual kw.h. consumption.

Another way in which power bills may be lowered is by improving the power factor. This may mean a reduction of as much as 5% in the power bill where the power factor is raised from 75% to a point between 95 and 100%. Low power factor is partly the result of operating induction motors at less than full load, and may be improved to some extent by using motors which are not too large for the work. This, however, is not always feasible, because of the high starting torque required by some machines. Much greater power factor improvements may be had by using static condensers or one or more synchronous motors.

In the quarry or pit the blasting and loading operations may justify changes in methods or equipment. Under some conditions the excavating and loading of the raw material may be more expensive than it should be, as where excessive boiler repairs are required because of worn-out equipment or hard water. In many cases electric shovels have been found to be more economical in the long run. The haulage system to the plant may be inefficient and costly due to excessive repairs to obsolete equipment or because of lost time resulting from derailments where the tracks are not properly maintained.

In the plant, changes may be desirable in the routing of the product through it, or more modern equipment may offer marked savings. The use of anti-friction bearings to save in power and maintenance, enclosed speed reducers instead of open gears and belts, modern control equipment, and proper wiring systems are all of considerable importance in attaining efficient operation.

High maintenance costs on any of the equipment are very liable to mean that the substitution of new and improved equipment would result in lower costs. While the saving in any single instance may not be great, the sum total may be well worth consideration.

Now Is the Time

In many plants, long needed improvements and changes have been put off, first because of inability to make them while operating, and more recently because of discouragement over conditions of the past year or two—like the leaky roof, to use a mixed metaphor, that couldn't be fixed while it was raining and was neglected in fair weather.

But now the cost of equipment is lower than it has been for a long time and changes can be made more easily and cheaply when the plants are not busy, so that this would seem to be an excellent time for any needed modernization. Also there has been a considerable improvement in equipment in recent years, so that much of the older machinery has become obsolete and is now at a disadvantage in competition with the new.

Indirectly, the installation of modern equipment now should help business generally through the reduction of unemployment and the increase of general purchasing power.

Contracts to Furnish Machinery Replacements at So Much Per Unit of Output?

THE ENGINEER of a well-known sand and gravel equipment manufacturer makes the following interesting suggestion: "I am inclined to believe that manufacturers of machinery will have to extend their services to producers. This may take the form of contracting to furnish replacements of equipment on a fixed price per cubic yard, or to guarantee that replacement costs will not exceed some fixed price per cubic yard. This is a difficult thing for a manufacturer to face, but it will have the effect of making some of them more cautious about performance guarantees than at present, and would tend to work to the advantage of sound manufacturers eventually."

Profits from Depression

A SMALL PRODUCER of crushed stone in New England gives some sound advice: "We sell our products for many uses and are continually finding new markets; we have to and so will others, if they are to stay in business. We are tending toward the development of special products for special purposes; even in the rock products industry whoever makes a better product has a better chance. We have had to adjust our business to the changed conditions. It seems to us that it is during times like these that you find out what really can be done. We have developed new and profitable markets, which four years ago we would not have considered worth looking into. When business comes back, as it will sometime, we will be in better shape for having gone through this trying period."

When Is a Cement Plant Obsolete?

By Aman Moore
Los Angeles, Calif.

IF natural cement manufacturers had been asked in the late 80's or 90's, "When does a cement plant become obsolete?" their answer would probably have been the same as that of a large majority of portland cement manufacturers today. They were unwilling to admit their plants inefficient and obsolete; that a new type cement, portland cement, had arrived to permanently take the place of natural cement. It required the building of many portland cement plants during the 90's to compel the natural cement manufacturers to admit their plants obsolete. They were compelled to close them down permanently; write off their many millions of invested capital. Some of them, however, built portland cement plants and continued operations as portland cement manufacturers.

It was my lot to be connected with the Buckeye Portland Cement Co., which built the fifth portland cement plant in the United States, near Bellefontaine, Ohio, in 1887.* This plant used marl and clay for raw materials. We first built four upright dome kilns; later, a continuously operating German Dietsch kiln for burning the dried bricks of raw materials into vitrified clinker. The kilns were fed in layers, the dried bricks burned, and the clinker discharged from grates at the bottom. The clinker was crushed with a jaw crusher and rolls and ground on old-fashioned French buhr stones. The quality of portland cement produced was nearly on a par with the average quality of portland cements manufactured today.

Who would dare say that a plant such as the Buckeye Portland Cement Co. operated would be a modern plant today?

Rotary Kilns

The main change during the 90's was the substitution of 6-ft. by 60-ft. rotary kilns for upright kilns. While 6-ft. by 60-ft. rotary kilns produced a more uniform clinker, they consumed approximately 150 lb. of pulverized coal per barrel of clinker, nearly 2,000,000 B.t.u., as against approximately 55 lb. of slack coal, or 715,000 B.t.u. consumed in the old upright German Dietsch continuous kiln. Therefore, the substitution of the small rotary kilns for the Dietsch upright kilns was no advantage so far as fuel economy was concerned. The one advantage was that from the 6-ft. by 60-ft. kiln, through the following 42 years, rotary kilns were developed that produce, or will produce, greater economy in consumption of B.t.u. per barrel of clinker burned, than did the Dietsch kilns.

From 1890 to the present, the size of rotary cement kilns has been increased from 6 ft. by 60 ft. to 11 ft. 6 in. and larger in diameter and to lengths varying from 200 to 400 ft. With this type of kiln the economy attained is such that a barrel of portland cement clinker can be burned with approximately 1,100,000 B.t.u. consumption.

The greatest single stride in developing the large diameter and long kiln was that taken by the late Thomas A. Edison about 1900. Edison designed and built two kilns at the Edison Portland Cement Co. plant at New Village, N. J., having a diameter of 8 ft. and a length of 150 ft. These kilns were built with flanged cast-iron sections bolted together and with supports every 12 ft.

In 1906 the writer installed the first modern kilns constructed of boiler plate, the same length and same diameter as the Edison kilns. These were installed at the plant of the Union Portland Cement Co. at Devil's Slide, Utah, and are still in operation.

Two years later, in 1908, the same size kilns, to-wit, 8-ft. diam. by 150 ft. long, were installed by the writer at the plant of the Southwestern Portland Cement Co., El Paso, Tex.

In 1911, the writer was also responsible for purchasing and later installing the first kiln longer than 150 ft., in the United States, at the plant of the Oregon Portland Cement Co., Oswego, Ore. This kiln was 9 ft. and 10 ft. in diameter by 210 ft. long. Since that date several plants have installed kilns varying in length from 200 ft. to 400 ft. I venture to say, however, that there are probably not more than 10% of all the listed operating plants in the United States that are now operating with kilns 200 ft. or more long.

Plants with kilns under 200 ft. are now obsolete, so far as kilns are concerned.† I further venture the statement that kilns up to 800 ft. in length will be installed in new plants in the very near future, and present kilns in operating plants will be lengthened to 800 ft. in order to completely modernize plants and reduce the consumption of fuel to a minimum; unless a substitute, in the form of a chain grate, for the dry process plants, is installed behind shorter kilns in some of the plants, as has been done recently at a few mills in Europe.

A kiln 800 ft. long, 11½ and 15 ft. in diameter, will easily produce 6000 bbl. per day with a fuel consumption of 42.3 lb. of coal having 13,000 B.t.u., or an equivalent of 550,000 B.t.u. consumption per barrel of clinker burned.

Evolution of Grinding Mills

The evolution of grinding mills in cement plants has been equally as great as the evolution of rotary kilns.

The greatest improvement, however, in the wet grinding has been largely adopted from the large copper plants of the west. What I refer to is closed-circuit grinding with compartment mills. The principle applies also to dry grinding with closed-circuit compartment mills. If the mill is wet grinding the material is passed to wet classifiers from each compartment separately, with the fines passing on to the slurry storage tank and the coarse particles, only, passing to the next compartment of the mill. In dry mills, the dry raw material discharges, in toto, at the end of each compartment. The fines are separated either by mechanical screens or air separators, with the fines passing on to storage bins and the coarser particles passed on to the next mill compartment.

The first ball and tube mill operating in tandem was, perhaps, more economical than

Editor's Note

***THE AUTHOR** presents an extreme view of cement mill obsolescence; and a vision of the future of the industry, one to which the editor is not yet ready to subscribe. For example, since no 800-ft. kiln exists, its accomplishments are matters of speculation, at least to a considerable extent.*

Nevertheless, the viewpoint here presented is surely interesting and will give readers something to think about. The author has spent a lifetime in the cement industry, promoting and building plants. He is indeed now engaged in trying to promote one without the obsolete features he describes here.—The Editor.

*While associated with the Buckeye Portland Cement Co. during the years of 1891 and 1892, I was privileged to have assisted in the construction of the first concrete street pavement built in the United States, including the four blocks surrounding the Court House Square in the city of Bellefontaine, Ohio. This pavement, built with "Buckeye" cement, is still in good condition today after 40 years of continual service. A sufficient proof as to the excellent quality of the cement used.

†Some cement companies have invested large sums to install waste-heat power plants, thereby utilizing the waste heat from the kilns. I would not advise the dismantling of these power plants, immediately. If a satisfactory quality of cement can be produced after a perfect raw mix is provided, then the operation of such power plants should be continued. I would not, however, advise the construction of additional waste-heat power plants at cement mills. The waste heat should be utilized in the kilns themselves by lengthening them. Greater efficiency can thus be obtained and less complications encountered.

a large number of compartment mills now operating in many plants not in closed-circuit system. The small grinding units have given way to larger units, which at the present moment will produce as large an output as 250 bbl. per hour, or 6000 bbl. per day of 24 hours.

Dry Ice as a Byproduct?

By lengthening the kilns to 800 ft. and providing a dust-collecting bag-filter house, the gases can be reduced to a temperature of approximately 200 deg. F. A barrel of clinker can be produced with approximately 42.3 lb. of coal, which is a more economical operation than that of a German Dietsch upright kiln.

Furthermore, the low temperature of gases, with the dust and solids removed, makes it possible to recover approximately 26.5% CO_2 from the gases and manufacture it into dry ice, which at a selling price of $25 per ton would show a larger profit than that of the output of cement.

Evolution of Power Transmission

There has also been a very great evolution in the transmission system in cement plants. Machinery was driven either by a belt or rope drive from a jack shaft. The plant of the Union Portland Cement Co., at Devil's Slide, Utah, built in 1906, eliminated both jack shafts and belt drives. All motors were direct connected to the driving shaft of the machinery. This system has been largely adopted by modern cement plants. Instead of direct-current motors, alternating-current motors are now used, either on the mill shaft direct or operating through one or several sets of reduction gears. Special motors have been developed so that the difficulties formerly encountered when attempting to start such heavy loads, as large compartment mills, have been overcome. The penalizing peaks of current consumption in the starting of these large mills have been greatly reduced or almost eliminated.

What Constitutes a Modern Cement Plant?

Six pieces of modern machinery, including the following, primary crusher, secondary crusher, raw grinding, closed-circuit compartment mill, kiln, cooler, and a finish grinding closed-circuit compartment mill, will produce 6000 bbl. per day, of modern quick-hardening portland cement; and when a plant is properly designed and erected, with the above named six units of machinery, it will constitute a modern, up-to-date cement plant.

The main problem is to know, from year to year, what constitutes a modern cement plant, and when a plant needs changing to continue it as a modern plant. During the past few years we have been improving so rapidly in all the equipment going into a cement plant, as well as greatly improving the quality of the cement itself, that a plant built even a year ago, might today seem to be, at least partly, obsolete.

Evolution in Quality of Cement

As the kilns, grinding mills and transmission machinery have gradually become much larger, and improved, during the past few years, greatly reducing and simplifying the operation of a modern cement plant, so also has the quality of portland cement greatly improved. It required the World War to bring forth the ingenuity of a cement chemist in Switzerland to produce, with practically the same raw materials, and almost the same chemical composition, a portland cement that would secure almost its full strength in 24 to 48 hours. Since that time most of the cement mills of Europe either have been modernized to produce this cement, or have been completely dismantled and new plants built with the same object in view.

Up to the present time most of the portland cement manufacturers in the United States have, apparently, used their influence to prevent quick-hardening portland cement from replacing the old style slow-hardening portland cements.

Transition Period Today Exists, Similar to That of the 90's

American portland cement manufacturers today are in very much the same position as the natural cement manufacturers were in during the 90's. They are slow to admit that another transition period is immediately ahead, whereby portland cement will be largely, if not altogether, replaced by a new modern quick-hardening portland cement.

This new product can be produced only in modern plants with fairly long kilns and with a perfect raw mix, which can be obtained readily by the use of three materials, unless it so happens that the clay material or the limestone material contains a larger percentage of iron than ordinarily exists in the usual raw lime, clay or shale, used by the 165 operating cement mills in the United States. The manufacturers, unless they are able to modernize their plants or consolidate them into large groups or combines, properly financed to modernize either a few of the old plants or build and equip a few large new modern plants, will, in my opinion, in the very near future be in the same predicament as the natural cement manufacturers were during the 90's; to-wit, they will find their plants too obsolete to manufacture a quality of portland cement that will be acceptable to the engineers in charge of construction throughout the United States and will, therefore, be compelled to close their plants permanently.

The present 165 producing cement plants in the United States have a nominal annual capacity of over 250,000,000 bbl. of old style, ordinary portland cement. This is truly a travesty on the judgment of those who in the past have been classified as successful business men. The peak of consumption in 1927 and 1928 was approximately 176,000,000 bbl. only. Fully 90% of these plants are now obsolete and fit only for the scrap pile. Many of these plants contain kilns as small as 6 ft. by 60 ft. and not more than 7 ft. and 8 ft. in diameter by 125 ft. to 150 ft. in length. These kilns might be used for coolers or for the back portion of a modern kiln. Otherwise they are valuable only for the steel plate they contain. Most of the grinding mills in these obsolete plants consist of small upright mills or old style ball mills, or tube mills, ranging from 4 ft. to 6 ft. in diameter and from 16 ft. to 22 ft. in length. A combination of a ball and tube mill such as described above, when operated in tandem will produce approximately 10 to 20 bbl. of cement per hour. It would require at least 13 ball mills and 13 tube mills operating in tandem, or a total of 26 separate mills, to give the same production of 250 bbl. per hour, as one modern large compartment mill, hooked up on a closed-circuit basis of operation, will have. The economy in power obtained by the closed-circuit system of grinding is so great that it does not pay to operate the old style ball and tube mills, unless rebuilt to conform to "closed-circuit" requirements.

The question therefore arises as to what shall become of the many hundreds of obsolete pieces of machinery, including small kilns, small grinding mills, etc., which fill up many of the 165 plants now listed as producers in the United States.

Transportation to Market

The grinding of raw materials in a wet slurry with the addition of 60 to 80% of water makes it possible to transport such slurry through a pipe line for an unlimited distance, at a small friction loss, and at much less cost than the transportation of oil by pipe line. There is no reasonable limit to the length of a pipe line carrying such slurry, with the use of a sufficient number of pumping stations along the line. The expense of such method of transportation is very small. It would, therefore, seem that the proper location of new plants will be near the large cities, where the market now exists. It is far cheaper to transport the raw materials in the thin slurry form through pipe lines, by pumping, than to transport the finished product a long distance by rail or truck.

The fuel can also be piped to the plant. Slack coal can be pumped and transported by water through a pipe line for any reasonable distance up to several hundred miles. Natural gas and fuel oil can also be piped for several hundred miles through a pipe line. Power can be generated either at the mill in power plants owned and operated by the cement companies, or can be bought from power companies, if price is made sufficiently low.

Modern Plants Should Be Located Near Large Cities

It seems to me that a few large plants built near great centers of population, with modern equipment, of capacities ranging any-

where from 6000 bbl. per day to 60,000 bbl. per day, or more, will be operated. Dealers can deliver directly from the mill to their customers' jobs, in tank trucks and tank trailers, in bulk, thereby eliminating the cost of packing, as well as the cost of storing in warehouses and the extra cost of double transporting, first from mill to warehouse, and from warehouse to job.

Similar to Smelting Situation in 1900

It is a very similar condition to that of the smelting industry some years ago. About 1900, the American Smelting and Refining Co. was formed. It acquired most of the operating smelters in the mining regions of the West, as well as in Mexico. There are probably only a few, if any, of the original smelters operating today. They were gradually dismantled, scrapped, and written off, one at a time, in after years. New modern smelters were built at points more advantageous for receiving ores from the mines. The smelting company has continued to be prosperous, through these many years, even though many obsolete smelters were dismantled and sold as scrap iron.

I have advocated a similar process for the portland cement industry. It will be a great hardship for the owners of each individual obsolete plant to take a total loss or attempt to replace with modern equipment. There should be a combination or combinations on a large scale. One or more large companies operating in the various large centers of population, with new plants, gradually will replace the old obsolete plants, which can then be dismantled, one at a time, and completely written off. If the owners of these plants would transfer their stock holdings into combined companies today, accepting stock in one of the new combinations for their present holdings, they would save their investments and be able to receive dividends, even though their own individual plant was never operated in the future, but instead, completely scrapped, as, no doubt, it would be, if managed on a strictly business basis.

Other Products Manufactured

Portland cement plants should also be equipped to manufacture other products besides portland cement, so that the cement industry would not be compelled to depend solely on the manufacturing and marketing of one product. During prosperous times the demand for cement is great. Plants are enlarged. New plants are built. Competition becomes more keen. Reasonable profits only are made during the most prosperous times, and then, when slack times prevail, building operations are the first to suffer. Consumption of portland cement diminishes. Cement factories are closed down, or output is so greatly curtailed that no profits are made and the entire industry demoralized.

With the installation of long kilns, with temperature of gases reduced, to approximately 200 deg. F., the 26.5% of CO_2 can be readily separated from the gases and manufactured into dry ice, thereby producing an additional product that will find a ready market at all times during the lean years as well as the prosperous years.

Other products such as magnesite products, gypsum products, fertilizer products, paint products, heavy chemicals, such as potash, recovered from the black sands of New Jersey or from leucite deposits of Wyoming, can also be produced; also the roasting of alunite and of magnesium sulphate, thereby producing cheap sulphur and cheap magnesium and aluminium metals; also the production of sulphuric acid from the cheap sulphur as a byproduct; also the use of sulphuric acid in treatment of phosphate rock, thereby producing phosphoric acid, desirable in the fertilizer industries; also many other phosphoric chemical compounds, so that the plant is transformed into a heavy chemical manufacturing plant producing not one only, but many products, including dry ice; all of which have stable markets through lean contruction years as well as prosperous ones.

In order to bring about such changes, I advocate, first, one or more major consolidations, taking in practically all the present operating cement plants in the United States. Second, to have each of the consolidated groups build one or more modern plants in large centers of population, with daily capacities ranging from 6000 to 60,000 bbl. or more. Also, utilization of a large part of the present obsolete machinery, including kilns, for coolers, for back ends of the long modern kilns, and the smaller grinding units for grinding products other than cement, after reconstructing them to operate by a closed-circuit system.

Individualism Eliminated

The old system of individualism in portland cement production should be abandoned forever. If not abandoned, then the present owners must face the fact that a total loss confronts them within the next few years.

At the time consolidations are made, ample new capital should be provided to carry through a complete program, including the dismantling of old plants and the construction of a few large new modern plants. Such a procedure is the only safe one.

Sands for Sand Blasting

THERE is a great difference in the working characteristics of sands in sand blasting, a report by the Canadian Department of Mines points out. This report, "The Suitability of Certain Canadian Sands for Use in Sand Blasting," states that the wearing quality of the sand, which is fairly uniform for any good silica sand, has no fixed relation to the cutting power. Tests upon which the report was based show that the cutting power of sand is dependent largely upon the angular edges of the sand. Not only do sands with sharp edges cut better than round grains, but they do not cause "ripple" marks as round grains do.

Cement Companies Aid Their Employes During Shutdowns

TROUBLE may have hit the operators of cement plants during the past two seasons, but their owners have tried to keep it away from their employes as much as possible, if the attitude of two companies is at all representative. Late in the past season two closed plants were visited by a member of the Rock Products staff in widely separated parts of the country, and at both plants his attention was caught by what the company was doing for its employes.

The plant of the Cumberland Portland Cement Co. of Cowan, Tenn., had only operated intermittently for more than a year when visited last August, but the company reported that its employes had not felt the loss of employment nearly so badly as it was felt at other places. The cause of the better conditions was simple enough, for the company had let its employes use a large portion of its property to plant grain and vegetables on. The property used was a great tract of land which is actually the company's clay reserve, but because it was covered with a good soil for farming it made excellent gardening land and has been developed to the highest possible degree by the workers. Each family has a set amount of ground to work—usually about an acre—and they can develop it in whatever way they choose. A great deal of the property is in corn, though there is also a considerable portion in potatoes and other vegetables. A spirit of friendly rivalry has grown up between the families to see which can produce the largest crops. This is the second year this project has been carried on by the company, and the results have been highly successful. Only a few families worked the project the first year, but this year practically every worker has asked for some land. The project keeps the men busy and helps the morale, as well as providing food for the families so that they do not need charity. Calls for aid from the Cumberland employes have been very few in Cowan during the past year.

Another plant that had not been operating regularly when visited was that of the Colorado Portland Cement Co. at Portland, Colo. When this plant was built, the company also constructed homes for its employes on the company property, making a small "concrete" town surrounding the plant. Since the kilns use natural gas for fuel, the company provided heat and light from the same source for the houses of the employes. These homes were leased to the employes at a fair rental. However, when the mill was forced to shut down, the company decided to waive the rents on these homes, so now the employes are obtaining their houses rent-free and have light and heat furnished to them without cost also, as long as the plant is shut down. The company should benefit in the end from this humanitarian move, as it certainly should increase the loyalty of the workers to the company.

Rehabilitation Work of the Missouri Portland Cement Co.

Practical Illustration of What a Live-Wire Organization Can Do to Meet Conditions

A YEAR OR TWO AGO the Missouri Portland Cement Co., St. Louis, Mo., felt that it was an ideal time, in order that work might be provided for its employes, to make certain improvements and changes in not only its cement plants but also in its sand and gravel plants, and in line with this thought the four small kilns at the Kansas City plant were replaced by two large kilns, in connection with which there were installed two large concrete dust chambers and two specially designed pre-coolers for the recovery of the heat from the clinker. Three kominuters and five tube mills used in connection with raw grinding were replaced by one large mill, the installation of which improved the fine grinding on raw material greatly. The finish mill was also overhauled, air separators and dust collectors being installed, which, of course, improved the fineness of the finish cement, and in addition to the above there was installed a new clinker gypsum proportioning station. The changes above mentioned increased the capacity of the mill approximately 20%, as well as improving the quality of the product.

In connection with the Kansas City plant the company is at this time quarrying stone to have in readiness when it opens up the mill in the spring.

At the Prospect Hill plant (near St. Louis) two compeb mills have been installed on clinker grinding, which replace 19 units heretofore used, and give an increase in clinker grinding capacity of approximately 1000 bbl. per day, and a great increase in fineness of the finish cement. At this plant a centralized coal mill has also been installed, replacing seven units heretofore used.

Relief Work

The program of relief work at the Prospect Hill plant this winter will consist of dismantling the old equipment in the old coal mill and the old clinker grinding departments, the installation of a dust-collecting system in coal mill, also the installation of a dust-collecting system in finishing mill of Plant No. 2, and further relief work will be furnished employes at this plant by repairing and painting the company houses, located near by, which are occupied by company employes. At the stone quarry in connection with this plant, located at Fort Bellefontaine, during the winter months it is the intention as a relief measure to lower the floor in the present quarry some 50 ft.

In connection with the Prospect Hill and Fort Bellefontaine operations, the company opened up on December 15, 1931, a commissary for the exclusive use of its employes, through which it has furnished them since that date, and intends to furnish them indefinitely, the necessary food supplies, coal, heavy winter underwear, etc., at the absolute cost of such articles to the company, the company not adding to such cost any overhead, clerk hire, or other charge. By doing this, the company feels that none of its men will be obliged to ask aid of any of the charitable institutions; in fact it has notified all local charitable institutions that should any of its men ask for aid that they communicate immediately with the company, as it is the intention to look after, as far as possible, all employes at the two above mentioned plants. And in addition to the commissary, a great many employes reside in houses owned by the company, and while they have been charged, during normal times, only a fair rent for these houses, in order to help them further to get through the winter, the rents they have formerly paid have been reduced 50%.

Rehabilitation of Gravel Plants

At the gravel plant on the Meramec river located at Jedburg, Mo., one of the dredge boats has been equipped with a Diesel engine, and a tower storage system has also been built and a sand and gravel unloading hoist installed, and the relief program for this winter calls for providing initial separation of material sizes by installation of the necessary equipment on the dredge, shifting of stock storage piles, painting of equipment and the buildings around the plant, the oiling of the interior of all the barges and hulls, and changing equipment around the washing plant.

On the Mississippi river one of the dredge boats has been equipped with a Diesel engine, and the relief program at the present time at this plant consists of oiling interior of barges and dredges, reconditioning of the floating equipment, and the probable electrification of hoisting equipment.

At the plant opposite the Tyler street plant on the Mississippi river in East St. Louis the relief work will consist of the probable electrification of the hoisting equipment.

At the Memphis, Tenn., gravel plant it is the present intention, in connection with the relief work, to replace the present 300-ft. wood conveyor bridge with one of steel, rebuild the waste flume, paint the equipment, do some work on the railroad tracks, reset the washing arrangement and paint and clean up the plant generally. A Diesel engine has also recently been installed on the dredge at this plant, and the sand and gravel screening plant has been rebuilt.

It is the plan during the winter months to spread the work as much as possible by alternating one week of work and one week lay-off, and it is hoped that in this way all of the men can be kept busy at least half of the time until such time as the company can open up each of the plants.

Mexican Cement Industry in 1932

THE CEMENT INDUSTRY of Mexico operated at somewhat less than 50% of capacity, though sales approximated 50% of those experienced in the peak year 1930.

There were no new developments in so far as the construction of new plants or the placing in operation of plants upon which construction had previously begun was concerned. Compania de Cemento Portland "Apasco," S. A., with plant at Apasco, State of Hidalgo, did little or nothing towards completing their plant upon which construction was started in 1930. Compania de Cemento "Azteca," whose small 50-bbl. wet-process plant at Puebla, State of Puebla, started construction in 1931, was still under construction.

Cementos Mexicano, S. A., with plants at Hidalgo and Monterrey, State of Nueva Leon, confined their operations to their Monterrey plant. Compania de Cemento Portland "Nacional," S. A., with plant at Hermosillo, State of Sonora, which was placed in operation the latter part of 1931, operated only several months during the year.

Compania de Cemento Portland "Landa," S. A., with plant at Puebla, State of Puebla, converted one of their cement kilns into a lime kiln and placed both caustic and hyrated lime on the market during the year, this being the first hydrated lime produced in Mexico.

"La Tolteca," Compania de Cemento Portland, S. A., with plants at Tolteca and Jasso, State of Hidalgo, and Mexico City, State of Mexico, confined their operations largely to their newer Mexico City plant.

The Jasso plant, which had been purchased by La Tolteca from Compania de Manufactura de Cemento Portland, "Cruz Azul," in the year previous, and closed down upon the starting up of the Mexico City plant, was expropriated by the State of Hidalgo and turned over to the workmen for operation, early in the year. Later in the year the purchase of the Jasso plant from La Tolteca was negotiated by the governor of the State of Hidalgo after months of legal battle where the case was thrashed out in the Hidalgo courts, finally ending up in the Supreme Court, and at the present time the Jasso plant is being operated by the workmen under supervision of the governor and committee appointed by the State Senate of Hidalgo.

Missouri Aggregate Producers Find a Way to Save Established Plants

Three-Cornered Agreement Between State Highway Department, the Railways and the Producers, Based on Economic Considerations, Solves Problem of Local Pit Competition

PRODUCERS of sand, gravel and crushed stone in Missouri have found a logical way to meet the competition of the local side-of-the-road plant, which should prove immensely helpful to owners of established plants everywhere, even in states where the highway departments do not directly purchase the materials, as in Missouri. The same line of reasoning applies where contractors purchase materials.

The Missouri problem was attacked by first presenting the case of the producers to the railways, and in obtaining the cooperation of the railway traffic departments. The producers and railways then presented a joint proposition to the State Highway Commission. This was done on October 10. On December 12 the State Highway Commission accepted this joint proposal with some slight modifications—these changes were the elimination of ten counties from "commercial aggregate territory," which extended investigation indicated could best be served by local production.

The committee of producers who negotiated the agreement were: John Prince, president of the Stewart Sand and Material Co., Kansas City, Mo., chairman; R. Newton McDowell, president of the Blackwater Stone Co., Kansas City; M. Moss Alexander, sales manager, Missouri Portland Cement Co., St. Louis, Mo., and G. C. Cooley, president, Cooley Gravel Co., Chillicothe, Mo. The original proposal, dated November 10, follows practically in full:

Rate Proposal—Missouri Railroads

The railroads of Missouri submit for consideration rates on sand, gravel, chatts and crushed stone, carload, which are a reduction of 20% of their present single and joint line scales. To these rates is added the emergency charge of 10% with maximum of 6 c. per ton. The emergency charge will be discontinued March 31, 1933, unless extended by authority of the Interstate Commerce Commission. Present and proposed rates are shown in Exhibit No. 1.

Reductions to apply on all aggregates used in the building of new roads and maintenance of present roads in the entire state.

These rates are the maximum in the 41* counties designated as Local Aggregate Territory, and the minimum in the 73* counties designated as Commercial Aggregate Territory.

In consideration of the reduction which the railroads are offering, it is with the understanding that the Highway Department will purchase and the railroads will be permitted to handle all road aggregates used in the 73* counties named in Exhibit No. 2, and discontinue the development of local production. The right is reserved to the Highway Commission to truck material from any designated established plant, providing the material so trucked will not exceed 10% of the material used in the Commercial Aggregate Territory in any one year.

Summary

(1) For the purpose of this proposal the state is divided into 73* counties designated as "Commercial Aggregate Territory," and 41* counties designated as "Local Aggregate Territory." The state expects to use a total of twelve million tons of aggregates in the next four years; of this, a total of eight million tons of material will be used in the Commercial Aggregate Territory.

(2) If the state continues its present plan of developing local production, it is expected about two and one-half million tons of local material will be produced in the Commercial Aggregate Territory.

(3) The railroads offer, on certain conditions, a reduction of 20% applying on all rail movement of these materials in the state of Missouri. Investigation shows that the average rate paid on these materials on the present scale will be 86c. per ton. The proposed reduction will, therefore, amount to 17.2c.

(4) If all of the tonnage in Commercial Aggregate Territory is shipped, and in addition there is a total of 400,000 tons shipped in the Local Aggregate Territory, then the resultant saving to the state in freight will amount to a total of $1,450,000.

(5) Offsetting this definite saving various statements have been made, indicating a saving to the state by production of local material. The estimate included herein indicates a saving of $1,400,000. Other estimates may indicate other amounts. In any event, such are purely estimates and cannot be developed with certainty in advance of the completion of the work.

(6) If local materials are used, they will in general have to be placed on stock pile before use. This will result in a probable loss to the state of 5%, or $125,000. The total saving of $1,400,000 due to the use of local material is, therefore, reduced to a total of $1,275,000. This is substantially less than definite saving in freight charges heretofore set out.

(7) There will be a saving in freight on 3,300,000 tons of material used for other

Editor's Note

THE EDITOR considers this one of the most important contributions ever offered Rock Products readers in the commercial aggregate industry, and he is grateful to his Missouri friends for their assistance in making its publication possible, as he is sure the industry will be, too.

Naturally, the main interest of the established commercial producer is to save his investment in plant and facilities. He can, of course, engage in portable-plant production if he chooses; but he should first exert every feasible and logical means to employ his established plant and facilities to save his investment. Not to do this is to entail an economic loss, not merely to himself but to the railways, to the state, and to society as a whole.

Mere protest against uneconomical side-of-the-road competition will avail little, even with strong political backing. A cold-blooded analysis, logical and unanswerable, is the only effective way to deal with any economic problem. The Missouri producers deserve great credit for initiating such an anlysis, and in accepting its results even when and where unfavorable to themselves.

The railway managements deserve credit for their capacity to see the light and to cooperate intelligently to restore some of their lost traffic. The State Highway Commission deserves great credit for its broad-gage view and its obvious desire to render the greatest good to the greatest number of the citizens of its state.

Every producer in every state is faced with the same problem; and if he will read through this presentation and absorb its logic and the method of approach, the editor believes a great step toward the solution of the local-pit competitive problem will have been accomplished.—The Editor.

*Amended, as shown in supplementary agreement at the end of this article to 51 and 63, respectively.

than supplemental surfacing of $570,000. This amount is, therefore, available for the construction of roads in those counties where there might otherwise be a shortage in mileage resulting from this proposal.

(8) A reduction of tonnage to the railroads and established producers by reason of the plan for local production, will necessarily increase the cost of service. This may be reflected in increased cost of materials to the state on those materials which, in any event, will need to be produced at established plants and shipped by rail.

(9) The total unemployment relief offered by the use of established plants and rail transportation is greater than it will be if local production is used.

Conclusion

It is evident that the general money advantage to the state will best be served by accepting the proposed reduction of rate offered by the railroads. This offers definite and positive saving in the cost of the state highway system. It will save the railroads and producers from serious reduction in tonnage badly needed and will prevent the loss of capital invested by citizens of the state in these industries. It will retain in their regular jobs the men now working. In many counties additional mileage of roads can be built and a way is proposed whereby no county need suffer loss of mileage. The state will continue to do business with those best equipped to serve the needs of the State Highway Commission.

Type of Highway Construction Contemplated

The construction of concrete highways throughout the state is, in a large measure, completed. During the next four years the emphasis will be placed on lower types of roads. The aggregates to be used will consist largely of surfacing material for the construction of the balance of the secondary system and the supplementary roads. The Highway Department estimates that the total use of materials during the next four years will amount to about twelve millions tons.

The construction of the surface type of road lends itself readily to the use of material produced from local pits and quarries. An examination of these sources of supply, in cooperation with the Highway Department, suggests at once that in certain areas, generally known as the Ozark region, there is a local supply of suitable materials, and the location of railroads is such that it will, without a doubt, necessitate the large use of local aggregates.

In cooperation with the Highway Department, it has been concluded that this region which is located in the southern part of the state, will naturally embrace about 41* counties. This area is designated "Local Aggregate Territory."

In the 73* counties designated as "Commercial Aggregate Territory," while there are available in many of the counties local deposits from which material suitable for the purpose may be produced, the deposits are not as general and railroad destinations are more numerous, and the general economy of producing material from local plants is more doubtful. These counties are listed in two groups and shown in Exhibit No. 2.†

*Amended, as shown in supplementary agreement at the end of this article to 51 and 63, respectively.

Kansas Producers Also Solving Problem

IN the state of Kansas the situation is very different from that in Missouri. As in most other states the Highway Commission does not buy materials; they are purchased by contractors.

With the experience gained in Missouri, however, a "rate contact committee" has been organized, joining in one representative group the railways, the producers and the contractors. The secretary of the committee is the secretary of the state aggregate producers' association.

The railways under this arrangement no longer make individual rate cuts, but when such rate cuts are proposed they are referred to the committee. Since the committee has been functioning, about two-thirds of the cuts proposed by the railways have been rejected by the committee as unnecessary. These cuts have usually been proposed by shippers, and the railways were ready to make them because they did not know enough about the situation to decide whether they were necessary or not. Sometimes the cuts have been purely competitive as between the railways. All these have been turned down.

Under the committee arrangement substantial cuts have been made in a few cases where such cuts will keep the traffic from moving by truck, or keep the materials from being produced by a local, side-of-the-road pit. In other words, through the "rate contact committee" it has been possible for all parties, producer, contractor and railway, to cooperate to solve an economic problem in the interests of all three, and in the public interest as well.—The Editor.

The Highway Department indicates, from its general survey of the use of the materials, county by county, throughout the state, that the total of all materials to be used in the construction of the highway system during the next four years will be generally divided as follows:

Commercial Aggregate Territory (73* counties)	8,000,000 tons
Local Aggregate Territory (41* counties)	4,000,000 tons
Total	12,000,000 tons

It is realized that the Highway Department cannot at this time anticipate exactly the requirements of material for use during the next four years. It has supplied what appears to be a sound estimate of the character and quantities of materials to be used in each county. It has generally set up percentages which will reasonably apply as to the division between the commercial material and local materials in the counties.

As a result of this investigation the tabulation below sets out the best information now available as to the quantities, use and origin of the materials required in the Commercial Aggregate Territory during the next four years. This division is based on the plan to extend the building of plants for the production of local materials.

From the table below it is evident that the Commission, Highway Department, Established Producers and the Railroads are primarily concerned with the decision as to the production and transportation of approximately 2,500,000 tons set out as local material not shipped.

It is conceded, on a basis of present freight rates and prices which have prevailed during the past two or three years, that this material can, where it is readily

†This tabulation is omitted here.

ESTIMATE OF MATERIAL REQUIREMENTS IN "COMMERCIAL AGGREGATE TERRITORY"

	Shipped from established plants	Local material not shipped	Total tons
T. R. and secondary roads, concrete aggregates, coarse and fine	1,018,570	113,170	1,131,740
T. R. and secondary roads surfacing	660,900	220,075	880,975
Maintenance surfacing	1,325,680	331,420	1,657,100
Supplemental surfacing	2,186,200	1,828,800	4,015,000
Additional fund change of type	300,000	.....	300,000
Total	5,491,000	2,493,000	7,984,000
Estimate 10% delivered by rail in 41* counties	400,000		
	5,891,000		
Total in 41* counties, T. R. and secondary concrete aggregate	342,000		
T. R. and secondary surfacing	527,700		
Maintenance	930,700		
Supplemental surfacing	2,255,000		
	4,055,400		4,055,400
Total material			12,039,400

available, be produced and put on the road for less cost to the state by the development of local plants than it can be by production of established plants and shipments by rail.

It is well known that for the last eight or ten years the Commission has had available a Department of Geology which has most effectively attempted to locate in the several counties deposits of materials suitable for use in the highways. It is natural that this department, having spent so much time and developed such intelligent results as to the location of suitable local deposits, should now insist and be able to demonstrate against any less informed group of citizens such desirability and enonomy.

It appears necessary, first, therefore, to examine the probable facts in this matter and determine as best we can the probable total of such savings and the probable effect of the procedure now proposed of establishing local points of production in most of the 73* counties classified as Commercial Aggregate Territory. To determine this it has been necessary to ascertain the probable average freight rate from the established producing points to each of the 73* counties, together with the cost of suitable aggregate produced by the established plants at point of origin and the cost of putting these on the roads as compared with the probable average cost of local production.

Examination in considerable detail of freight rates now applicable indicates that the average freight rate from the established producing points to each of the 73* counties will be about 86c. per ton.

Examination in more detail of the average freight rate applying from each of the established producing points to the destinations served from that point indicates a variation in this average from minimum of 75c. to maximum of 95c. per ton.

The tabulation of the left covers average conditions which may reasonably be expected to prevail in territories served by established producing plants. When applied to the tonnage required in the several counties, it shows the average saving the state may expect to make if it proceeds with promotion and construction of local producing plants in these territories.

Explanation of Tabulation

The price of surfacing material from established plants can be verified by the Department and firm offers to furnish this material for year of 1933 at these prices or better are available from the established producers.

The freight rate shown is the average of that applying to the county seat of the several counties properly served from the producing point in the district set out.

The cost of unloading from cars to trucks or loading from stock pile to trucks is probably high, with the advantage in favor of unloading from cars, but in these comparisons the same figures have been used on both sides.

Trucking costs either from the railroad destination or from local stock pile are based on a rate of 6c. per ton mile. This may be high under ordinary conditions and may be low under provisions for unemployment relief. This rate represents a fair average during the next four years.

In the 73* counties considered "Commercial Territory" it will be found there is a total area of 41,000 square miles.

Investigation further discloses that in this area there is a total of 5638 miles of railroad line having approximately 940 unloading points in the 73* counties. It is, therefore, evident that on the average each unloading point serves 44 square miles of area, and on the average any point in any of the 73* counties above referred to can be reached by truck haul from the railroad unloading point on an average of 3.2 miles.

In order to meet the fact that all railroad

COMPARISON COST OF SURFACING MATERIAL FROM ESTABLISHED PLANT WITH LOCAL PRODUCTION

KANSAS CITY DISTRICT

	Estab. plant, crushed stone		Local plant, crushed stone
Cost of material	$0.90	Cost of material in stock pile	$1.40
Average freight rate	.83	Load truck	.15
Unload cars	.15	Haul 2 miles	.12
Truck 6 miles	.36		
Total cost	$2.24	Total cost	$1.67

Saving per ton for 210,000 tons 57c. or $120,000

SAMPSEL DISTRICT

	Established plant, gravel		Local plant, crushed stone
Cost material	$0.70	Cost material in stock pile	$1.40
Average freight rate	.95	Load truck	.15
Unload cars	.15	Haul 2 miles	.12
Truck 6 miles	.36		
Total cost	$2.16	Total cost	$1.67

Saving 49c. per ton for 402,000 tons or $197,000

LA GRANGE DISTRICT

	Established plant, gravel		Local plant, gravel
Cost material	$0.40	Cost material in stock pile	$0.80
Average freight rate	.90	Loading trucks	.15
Unload cars	.15	Haul 2 miles	.12
Truck 6 miles	.36		
Total cost	$1.81	Total cost	$1.07

Saving 74c. per ton on 178,000 tons or $131,000

ST. LOUIS DISTRICT

	Established plant, gravel		Local plant, gravel
Cost material	$0.40	Cost material in stock pile	$0.80
Average freight rate	.84	Load trucks	.15
Unload cars	.15	Haul 2 miles	.12
Truck 6 miles	.36		
Total cost	$1.75	Total cost	$1.07

Saving 68c. per ton on 481,000 tons or $327,000

LUTESVILLE DISTRICT

	Established plant, gravel		Local plant, gravel
Cost material	$0.65	Cost material in stock pile	$1.00
Average freight rate	.83	Load trucks	.15
Unload cars	.15	Haul 2 miles	.12
Truck 6 miles	.36		
Total cost	$1.99	Total cost	$1.27

Saving 72c. per ton on 195,000 tons or $140,000

JOPLIN DISTRICT

	Established plant, chatts and crushed stone		Local plant, crushed stone
Cost material, ⅓ secondary	$0.44	Cost material in stock pile	$1.40
⅔ supplementary	.44	Load trucks	.15
Average freight rate	.76	Haul 2 miles	.12
Unload cars	.15		
Truck 6 miles	.36		
Total cost	$1.71	Total cost	$1.67

Saving $0.04 per ton on 220,940 tons or $9,000

SUMMARY

	Tons	Saving per ton	Amount
Kansas City district	210,000	$0.57	$120,000
Sampsel district	402,000	.49	197,000
La Grange district	178,000	.74	131,000
St. Louis district	481,000	.68	327,000
Lutesville district	195,000	.72	140,000
Joplin district	220,940	.04	9,000
Total	1,666,940		$924,000

Average saving per ton, 56c.

*Amended, as shown in supplementary agreement at the end of this article to 51 and 63, respectively.

unloading points in any given area are not equally available as the short haul destinations of established plants, we have for the purpose of comparison used six miles as an average haul from railroad unloading points, thereby doubling the theoretical distance.

The average price for local materials set out in the above tabulation is $1.40 where crushed stone is used, and 80c. where local gravel is used. These figures represent an average cost for such production throughout the 73* counties and are intended to represent no isolated cases where incompetent contractors have bid on this work and failed to complete or lost substantially in the transaction. Rather they represent an average of what is believed to be a fair price at which competent, properly financed contractors will undertake the work. This estimate has been furnished by the State Highway Department.

In the final tabulation following those showing comparison of cost of surfacing material from established plants with local production, there is shown an average saving of 56c. based on production of 1,667,000 tons. It seems reasonable to assume that this average saving can properly be applied to all of the material which it is proposed by the Department will be produced in local plants in the 73* counties referred to. This, therefore, will result in total saving on 2,500,000 tons material of $1,400,000.

In order to get the benefit of the short haul in the establishment of local plants, to which we have herein given full credit, there must of necessity be a limited amount of tonnage produced in each plant. For a total of 25,000 tons of material it would probably be unwise for either the contractor or the state itself to go to the expense of installing a local plant having a daily capacity in excess of 150 or 200 tons. In planning for the operation of such plants the Department has most properly made allowance for the fact that it will generally be necessary to stock pile this material before it is placed on the road. It would not be wise to maintain any given road in grade condition ready to receive surfacing material during the time necessary to produce this material in a local plant. Without a doubt there is substantial loss in material incident to stock piling, and should this amount to as much as 5% it would represent a loss of 125,000 tons or at a cost to the state an average of $1 per ton in stock pile. This would amount to a total of $125,000.

The above amount should properly be deducted from the apparent saving to the state resulting from the use of local production.

Employment of Labor

The Commission is undoubtedly interested, particularly during the present emergency and for perhaps the first six months of 1933, in the maximum employment of labor to be obtained from every dollar spent in the highway construction. It is the general belief that the construction and operation of local plants will greatly increase the employment of labor throughout the state as compared with production of the same material in established plants and transportation via rail.

While each individual operation cannot be analyzed, a typical case can be examined to see how this comparison works out.

The railroad records will show that slightly less than 0.01 man-hours of railroad employes' time is spent for each ton-mile of freight handled. As the average movement of the material hereunder consideration is approximately 60 miles, it is evident that if this material is moved by rail, such movement will furnish employment for 0.575 man-hours.

In the case of recent bids submitted on the installation and operation of the local plants for production of crushed stone surfacing material the following figures were found to apply:

	Man-hours per ton
Labor to set up and dismantle plant	0.188
Plant operations	1.470
Truck to stock pile	0.105
Load trucks	0.430
Deliver two miles	0.110
Total	2.303

As compared with the above, the operation of established plants producing the same material under the Unemployment Relief provisions, the following effect is found:

	Man-hours per ton
General plant operation	1.046
Average railroad labor	0.575
Unload cars	0.430
Truck six miles	0.343
Total	2.394

It is evident from the above figures that more man-hours will be employed in operation of established plants with railroad transportation than will be employed in the local plant.

It may be contended that the operation of local plants will give more labor in the locality where the material is used than if the established plants and railroad transportation is used.

All of the labor used, whether rail or truck, established plants or local, is local labor; however, this may not be local to the point of use. The above figures show that in any event at least one-third of the total labor incident to the material used will be employed at the point of use.

It would seem to be a reasonable conclusion that it is better to keep the men employed on the railroads and in the established plants who are accustomed to this employment and working with a reasonable degree of efficiency ,than it is to throw these men out of employment to seek charity or unsuitable employment and give relief to the local group entirely unfit and unacquainted with the work.

It is evident, therefore, that the best interests to the state as a whole with reference to the Unemployment Relief will be served, and the most employment given by confining the production of these materials to the established plants using railroad transportation.

It is evident that the development of extensive production of local materials, if encouraged by the state, will substantially reduce the output of the established plants. It will also reduce the market for commercial material in a substantial area surrounding each of the local installations. This will result in materially reducing the available business for both the established producers and the railroads, and will tend to destroy for a long time to come the value of a large part of this investment.

A reduction in the demand for the product of any industry, whether it be a producer of crushed stone or a railroad, results in a higher unit of cost of that commodity. This is evidenced by the position of the railroads at the present time. They have less flexible cost characteristics and a fixed selling price for their commodity, but with the reduced demand for their product they are now showing substantial over-all losses. With the commercial producers, a decrease in demand can result, in the long run, only in increased cost and increased selling prices.

The result of the promotion of many local plants for production of these materials can, in the long run, result only in higher prices for these materials in commercial use, and higher prices for such materials as the state may hereafter secure from the established producers.

No attempt is made to set up the dollar value of this increased cost to the state.

Under the plan proposed herein whereby the railroads offer a reduction of 20% of the published rate for the movement of these materials throughout Missouri and the producers agree to a maximum price which will be charged to these materials at point of production, the total cost of all of the road work of the state will be reduced. It is realized that in some counties under this plan the cost of all types of roads will be reduced, where in other counties the cost of Supplemental Roads will be increased due to the higher cost of material shipped into those counties and compared with the cost of local material.

In these same counties the cost of other types of roads using large percentages of shipped-in material will undoubtedly be reduced.

In each county the total miles of Supplemental Roads which can be built depends on the cost. Therefore, if the costs are increased materially, the miles of road will of necessity be reduced.

It must be carried in mind, however, that even under the program of developing local plants, the state still plans to ship a total of 5,500,000 tons as set out in the foregoing; of this, 3,300,000 tons is to be used for pur-

*Amended, as shown in supplementary agreement at the end of this article to 51 and 63, respectively.

poses of the ... construction of supplemental roads.

The saving proposed by the railroads 20% of the present rate will amount to total saving in the movement of 3,300,000 tons of about $570,000.

We see no reason why, in the event the Commission elect to accept this proposal and make the saving set out, this amount of $570,000 could not be used for completing the necessary mileage in the counties unfavorably located above referred to.

RATES ON SAND, GRAVEL, CHATTS AND CRUSHED STONE, CARLOAD, IN CENTS PER TON 2000 LB.

	Single line		Joint line	
	Pres.	Prop.	Pres.	Prop.
10 mi. and under	50	40	65	52
20 mi. and over 10	56	45	71	57
30 mi. and over 20	62	50	77	62
40 mi. and over 30	68	54	83	66
50 mi. and over 40	74	59	89	71
60 mi. and over 50	80	64	95	76
70 mi. and over 60	85	68	100	80
80 mi. and over 70	90	72	105	84
90 mi. and over 80	95	76	110	88
100 mi. and over 90	100	80	115	92
110 mi. and over 100	105	84	120	96
120 mi. and over 110	110	88	125	100
130 mi. and over 120	115	92	130	104
140 mi. and over 130	120	96	135	108
150 mi. and over 140	125	100	140	112
160 mi. and over 150	130	104	140	112
170 mi. and over 160	135	108	145	116
180 mi. and over 170	140	112	150	120
190 mi. and over 180	145	116	155	124
200 mi. and over 190	150	120	160	128

Railway Employes

The number of railway employes in Missouri for:

1929	51,222
1930	47,278
1931	38,482
A. T. & S. F. and C. G. W. not included.	Or reduction of 24.9%.

In this connection we desire to direct the Commission's attention to statement made previously in our findings, as follows:

"It would seem to be a reasonable conclusion that it is better to give the men employed on the railroads and in the established plants who are accustomed to this employment and working with a reasonable degree of efficiency, than it is to turn these men out of employment to seek charity or unsuitable employment and give relief to the local group entirely unfit and unacquainted with the work."

Railway Wages

It will no doubt be interesting to the Commission to know that the Missouri railroads, except the A. T. & S. F. and C. G. W., paid out in wages as follows:

1929	$87,826,696
1930	80,960,938
1931	65,228,833

Railway Purchases

Railroads of Missouri, except the A. T. & S. F., C. G. W. and St. L. S. W., purchases amounted to:

1929	$49,070,533
1930	32,379,515
1931	15,849,431

*Amended, as shown in supplementary agreement at the end of this article to 51 and 63, respectively.

It is impossible to conceive that there is any one or combination of industries within the state of Missouri that have disbursed this amount of money in purchases, which has materially assisted in financially maintaining the industrial integrity of our state.

There is but one conclusion to be reached in connection with the falling off of purchases as shown by the comparison of 1931 with 1929, and that is, decrease in tonnage on the railroads, which naturally curtails their purchasing power.

During the year 1931 all Class One Railroads paid in taxes to the state of Missouri, $3,730,118.07.

We are sure that the Commission will take into consideration the further decrease in employes if any appreciable amount of the road aggregate is diverted from the railroads. Likewise, the decrease in the spending power of such employes will be felt in all parts of the state, which means further unemployment of railroad labor, which is at the present time larger than any other industry or combination of industries.

* * * * *

Counter Argument by Highway Department

Under date of December 1 the State Highway Department submitted to the Commission a summary sheet showing a comparison of the present methods of purchasing materials and the method proposed by the producers and the railways, giving a tabulation by counties (omitted here). It also submitted a map showing the location and distribution of local material sources, together with an explanation of the figures used—objecting in some instances to those used by the producers. This tabulation showed a saving to the present plan of approximately $149,000. An additional saving of $229,240 was considered probable. The tabulation by counties showed the savings under "Plan No. 1, consisting of the cheapest combination of purchasing materials locally, or commercially, shipped by rail or truck"; and the savings under "Plan No. 2, consisting of purchasing all materials from established plants and shipping by rail with a 20% reduction from the present established railway rates." The totals are $667,591 for Plan No. 1 and $518,415 for Plan No. 2—a balance in savings for Plan No. 1 of $149,176.

The figures used were based on the units of 80c. per ton for local gravel and fine and coarse aggregate for concrete and $1.50 per ton for locally produced crushed stone for surfacing. These units were used in order to be certain of being entirely fair to the proposition as submitted, it is stated. Experience and records indicate that these units would more nearly approach 65c. per ton and $1.40 per ton respectively, the report continues. Ten cents per ton saving is effected in many cases by hauling local material directly to the road, thus eliminating one handling charge. The correction of units as indicated plus the saving in handling charge would show an additional probable saving of approximately $354,000 for the present plan. The producers could fairly advance the argument that this additional saving might be offset to the extent of approximately $124,863 by the elimination of the emergenry freight rate charge of 10% (maximum 6c. per ton) plus extra stockpile waste and incidental savings in the 41* counties listed as local aggregate territory, leaving a conservative net additional saving of $229,274 to be added to the saving of $149,176 shown, or a total saving of $378,450 in favor of the present method of purchasing materials, i.e., a combination of contractor furnished and state furnished, local and commercial production.

In its report the State Highway Department also raised a number of issues of policy, which it considered desirable for the Commission to consider, as follows:

Issues of Policy to Be Decided

1. The Federal Government is attempting to discourage the practice of state furnished materials. In the face of such an attitude, and numerous other considerations, does the Commission desire to be committed to the purchase of the major portion of all materials over an extended period of time?

2. An inescapable effect of the new plan would be the material reduction of mileage of supplementary roads in counties favored with local deposits—this reduction in mileage to be spread over counties less favorably situated as regards local material. This would, in effect, be the same as a change in allocation of funds and might bring forth vigorous protest from counties so affected.

3. The proposed plan would eliminate all possibility of the real or apparent benefit to local labor in small communities and agricultural areas, and would transfer these benefits to more thickly populated areas. Under the plan now in use, some distribution of these benefits between the two types of communities is possible.

4. Railroads are overcapitalized and perhaps must eventually shrink capitalization as have most other industries. Would careful thought on this point lead to the conclusion that rates over an extended period of time will be as high as those proposed in this plan, or will they be revised to fit a logical capitalization and to meet a growing competition, and be set at a lower level than that here proposed?

5. Administration of the plan as proposed by the material-producers group would encounter numerous cases in which the shipment of materials would involve such a radical departure from economy as to be very apparent to local citizens and, even though it might be justified by the results of the plan as a whole, would be very difficult of justification to those locally affected.

6. Is the development of local material, as now practiced, a new plan? Is it not rather a logical development of the policy always followed? As a matter of fact commercial producers and shippers handled more aggregates and surfacing material in proportion to construction money spent in this biennium than in the preceding period. Is not the decrease in the business of these producers traceable to the fact that other outlets for their material are inactive at this time rather than to any diversion of business by the

Highway Department? Does not this place the producers in the position of seeking an added increment of business, not previously available but now in the picture largely because of the addition to our system of a large mileage of very low type roads?

7. Any burdens of the new plan will fall in a major portion on low type roads, increasing their cost per mile in a larger ratio than would be the effect on higher type surfaces. It is on this type of surface that the Commission has consistently sought to reduce the cost per mile.

8. Are the owners of equipment, designed and purchased for the production of local material, and who have built up organizations for this type of work, entitled to consideration in this connection, or does the exclusion of the 41 local counties satisfactorily take care of this phase of the situation?

9. Are other forms of transportation, such as trucks, logical factors in the evolution of the transportation facilities which may be taking place at present, and if so, would the proposed contract be logical without a preliminary hearing for such interests, even though they may be relatively unorganized at present?

Agreement Signed with Amendments

With the elimination of ten counties from Commercial Aggregate Territory, the proposal was accepted by the Missouri State Highway Commission, effective December 15 and to continue in force through the year 1933 and thereafter unless canceled by either party on 60 days' notice.

The railroads of Missouri agreed to abide by the rate schedules as offered herein to the Highway Commission without publication of same, and the acceptance of this proposal constituted an agreement between the Highway Commission and the railroads of Missouri for the protection of these rates between points in Missouri and points in Kansas City, Mo., zone, as described in I. C. C. Docket 17,000—Part 11-A.

The committee of the established producers agreed to submit promptly to the Highway Department firm and satisfactory offers for furnishing of the materials required by the Department for 1933.

Nothing in the proposal is to be construed as in any way affecting rates for the delivery of aggregates for specific jobs already let but not yet completed, where such rates have been approved and made of record.

The Key to Profits

THE GENERAL SUPERINTENDENT of a large rock products organization offers the following: "If I were a ruling hand of any industry I would manufacture at a cost to meet any price that would net any manufacturer a profit, and produce a product that would be superior to any on the market. It would be suicide to sell at a price which will not net a profit, as many are doing today, so I say I would meet any price that would net any manufacturer a profit; and by doing this I would figure to make a larger profit than my competitor, should he have the business."

Small Diversified Markets and Secondary Roads Offer Immediate Markets

AT THE TIME most of the subscribers of ROCK PRODUCTS were "interviewed" on business prospects for the next few years the outlook for highway construction, general building and public works was not very "hot," except in some few localities where some large projects under R.F.C. financing seem assured. Since then it would appear that under the new administration in Washington, after March 4, 1933, there will be considerable agitation for a large public works bond issue, and very likely some loosening up of the R.F.C. financing for "self-liquidating" construction projects. So the construction outlook may not be so gloomy.

In general, most producers who have studied their market problem seem to have come to the conclusion that home building, farm use, commercial construction, etc., and secondary highway surfacing offer the best possibilities in the near future.

Products

Portland cement manufacturers are divided in their opinions as to what will be demanded in their product in the future. The tendency toward a product of special properties for special uses has of course received a great impetus through the research work done in connection with the Hoover dam, and the specifications for cement for its construction. The product demanded for this work is nearer some of the portland cements of 25 years ago than those looked upon as modern. However, some producers believe that normal portland cement will gradually reach the quality of high early strength cement, and the industry will once more be on a single standard basis. Some also believe competitive conditions will enhance the development of special products. On the other hand, the utmost economy of production would seem to demand a standard product. Apparently the safest "bet" is expressed by the chief executive of one of the largest companies: "There is a tendency toward the development of special products for special purposes; the final result will probably be an increase in the number of 'standard' products." Another chief executive sees quite definitely two ultimate standard products: "The present standard specification probably should be modified; I believe it possible to do this in such a way as to provide a cement of low volume change and assured durability, and at the same time keep the early strength sufficiently high for all ordinary purposes; in addition to that, the present specifications for high early strength cement should be retained and this product used where quick-hardening is essential. In this way the industry would have two products, one or the other of which would meet every legitimate use."

In the crushed stone industry there has been a distinct trend toward special products for special purposes, and more than one producer states that this has been a life-saver to him.

Sand and gravel producers, in general, are finding specifications more rigid; as one producer aptly puts it: "We look for more rigid specifications all the time; sand and gravel plants are never all right for very long." Greater standardization is also expected, especially in view of the work done and in progress by the National Sand and Gravel Association.

A representative gypsum producer sees continued improvements in products under increasing competition; a year or two ago, he says, most firms felt that the remedy for falling sales was in the development of new products; he thinks now that this tendency is reversing; these firms have found it expensive to break into new markets, and have decided to concentrate on present lines; improving markets, lowering manufacturing costs and doing their best to increase sales.

Coordinate Sales Effort

A FLORIDA sand and gravel producer remarks: "You have covered the ground very thoroughly in your questionnaire. However, the condition of sales effort has been avoided. In our section we have solved the sales problem through centralization, and find this solution extremely satisfactory."

A Michigan sand and gravel producer: "Our industry is its own worst enemy. The decrease in consumption has made certain producers desperate for business, and they have demoralized the market. Local production has helped. For most units the only hope lies in consolidations, with marketing arrangements among these larger new units."

Appoints Receiver for Kentucky Consolidated Stone Co.

BEN S. WASHER, Louisville, and Sam P. Burnam, of Richmond, Ky., have been named joint receivers for the Kentucky Consolidated Stone Co., of Louisville, operating 11 quarry and stone crushing plants scattered over the state, and representing a merger of these interests some five or six years ago.

The petition for receivership was filed December 6. In addition to the receivership, the petition asked for a judgment in the amount named.

The action is of a constructive, or friendly nature, it was stated by Mr. Sachs, who held that the stone company is solvent, and that its operations can be continued if its affairs are properly handled.

New Products and New Uses for Rock Products Plants

THIS BRIEF SUMMARY does not attempt "to cover the field" in the way of new developments in the rock products industry during 1932. It is merely suggestive of what is going on.

Plaster Board for Exteriors

The Century of Progress Exposition to be opened in Chicago early in 1933 is an interesting example of experimentation in building construction of a cheap non-inflammable type, though of course in no sense fireproof. Most of the buildings are light steel frame construction with various wall coverings—sheet metal, ply-board, asbestos-cement board, and latest and most successful of all, gypsum board.

Clarence W. Farrier, assistant director of operation, describing the adoption of gypsum board recently said: "We had contacted the gypsum industry very early in the study of our problems, and they had been unwilling to recommend any board for us to use on the outside of buildings. However, by the time the contract was ready to let on the Electrical Building they had a material which was approved for use on the exterior.

"To give an idea of how much the costs went down: the cost on the asbestos-cement board in place was about 16½c per sq. ft. The cost of the plaster board in place is around 5½c per sq. ft. This reduced cost is due to the cooperation of the gypsum industry in developing a special material for our purpose."

Mr. Farrier believes that this experience points the way to cheap, non-inflammable houses and buildings of a new type.

Commenting on Mr. Farrier's quotation M. H. Baker, president of the Material Gypsum Co., Buffalo, N. Y., writes:

"Very little effort has been made in the past for developing the use of gypsum board for building exteriors and it is to the credit of the engineers for A Century of Progress Exposition for insisting on the manufacturers working this out for use on the World's Fair buildings. First the board had to be treated with a sizing material that would make it weatherproof which was done only after a great deal of research and experimentation by technical engineers for A Century of Progress combined with those of the leading paint manufacturers, along with our own research engineers. This resulted in the use of aluminum paint.

"In order to do this economically it was necessary that the paint be applied at the gypsum mill and done automatically with the manufacture of wallboard. Finally engineers were able to design spray machinery and other apparatus that made this possible, thus giving us a weatherproof coating sufficient to stand the ravages of the elements through exposure directly on Lake Michigan during the severe winter months and still a product at comparatively low cost.

"We are manufacturing this wallboard in size 4- x 12-ft. and since it is used on large surfaces there immediately developed a problem in treating with finish for the joints. Here it was found that a close fitting tongue and groove edge filled with a mastic cement made a weather-tight joint.

"Naturally the question of structural strength had to be considered and it was found that gypsum board manufactured in ½-in. thickness and used horizontally, fastened at right angles to the studding gave plenty of strength to the buildings.

"The color artists in designing the use of bright, lustrous colors pointed out that since these colors were very expensive it was important that the wallboard absorb a minimum amount of color. This brought into the use of wallboard a factor new in the development up to that point. Here again research engineers found that by applying the aluminum paint under heat a sufficient amount of oils would be absorbed into the surface of the board to effect positive priming to eliminate absorption from the final paint coat.

"The matter of fireproofing has been a big consideration in this use of gypsum board in that the buildings are all of frame construction. A greater amount of fire protection is obtained through the use

General Exhibits Building, Century of Progress Exposition, Chicago, 1933

Approximately 400,000 sq. ft. of gypsum board used on interior and exterior of building. An aluminum sized ½-in. tongue-and-grooved gypsum board 4 x 12 ft. was used on the exterior. Both faces and all sides and ends of the board are sized. Boards are applied both vertically and horizontally, depending on decorative needs. Cracks are filled. In some places board is applied to curved surfaces having radius of approximately 12 ft. Structural frame is steel with secondary framing of 2 x 4-in. studs. Half-inch board is applied to exterior and ⅜-in. sized board to interior. Floors are steel joists with steel deck. Light channels are tied to under side of joist and 16 x 48-in. gypsum board is fitted in these channels, giving a paneled or stripped effect—with the underside of the channel (16 in. on centers) running the length of the area—in some cases several hundred feet

of gypsum board than any other material known. It should be borne in mind that these buildings will be finished both inside and outside with gypsum board making them primarily gypsum buildings—a city of buildings costing upwards of $15,000,000—a city built of gypsum.

"We feel that this use of wallboard, as it will be inspected by several million people from all over the world, will demonstrate its practical use in this beautiful and original type of architecture, its economy for low cost building and once and for all the durability of wallboard."

"Designed" Cements

Research in connection with the cement to be used in the Hoover dam points to "designed" cements, the chief varying factor being the percentage of tricalcium silicate. Changes in the percentage of this ingredient affect not only speed of hardening but temperatures during hardening. It is probable in the future portland cement will be made according to specifications for particular uses of which quick-hardening and low-temperature-hardening, mass-concrete cement are but two. The two most desirable ingredients of portland cement are tricalcium and dicalcium silicates. Possibly eventually processes will be developed for making these separately and combining them in any proportion desired.

The probable use of cement grout as a binder for macadam type roads has led to the development of a special product with a bituminous admixture having slow-setting properties to permit of the road being rolled thoroughly after grouting.

Ground Dolomite for Fertilizer Filler

Elaborate experiments at the University of Tennessee agricultural experiment station have established the fact that the addition of pulverized dolomite to superphosphate fertilizers is advantageous. Hitherto, there has been objection to dolomite fillers because of their alleged tendency to "fix" the phosphoric acid and render it less available for plant growth. The conclusion of the Tennessee investigators is: "Superphosphates may be mixed with either true or near dolomite in any proportion and fineness and under any workable condition without producing any triphosphates in the finished product." This opens up a new market to dolomite quarry men.

Mineral Wool—Dry Ice

The state geologist of one of our great Mississippi Valley states visions a great industry making mineral wool, or rather "rock wool" by smelting and blowing steam through a limestone slag. Limestones of the proper ingredients are common in several of our "limestone states." The building industry of the future with a demand for fireproof materials, insulation, lightweight wall and floor units, etc., will increase demand for "rock wool."

The attempt of one organization to use the term "dry ice" exclusively has been defeated in the courts. Dry ice is solid or frozen carbon dioxide. Carbon dioxide is wasted by the millions of tons annually from the smoke stacks of cement mills, and the kilns of lime plants. Some day probably it will be recovered and sold. The use of dry ice as a refrigerant is growing rapidly.

Acoustical Products

Progress continues in the development of acoustical plaster. Eventually the market for these will expand to the ordinary dwelling house. We shall have not only air-conditioned, insulated homes, cool in summer and healthfully warm in winter, but peaceful rooms, with sound-absorbing plaster walls.

Potassium Silicate

The Grasselli Chemical Co. recently placed a new product on the market of interest to silica producers—potassium silicate, a competitor of sodium silicate for many industrial uses.

Use for Idle Plants

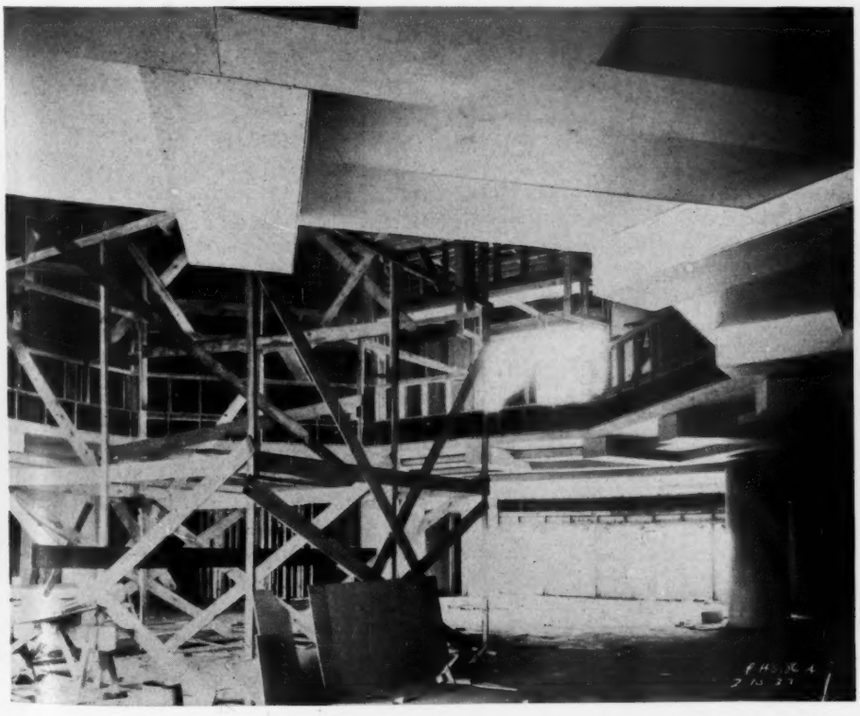
An Illinois limestone operator has let "a concession" to two young agricultural graduates to use a part of his limestone mine for growing mushrooms.

A Michigan cement plant is using its idle grinding mills to make pulverized coke, to be used as fuel in power plants. Possibly pulverized coal might become a side-line with other plants.

An Ohio sand and gravel producer has organized a subsidiary company to take dredging contracts from the government on inland waterways.

Conclusions

As was said in the opening paragraph, these items have been given only as suggestive. Rock products producers have plants representing investment of millions of dollars. Demand for standard rock products for the next year or two probably will be low. What are you going to do with these plants? Close them up, or use a little ingenuity and see if some use can be made of them?



Hall of Science, 3/8-in. gypsum board on ceilings and most interior walls. Outside of plywood which was painted with aluminum paint after erection

Optimism from Texas

A TEXAS sand and gravel producer: "We believe business conditions in our line are like those in most other lines of industry. There has been too much expansion for the last few years; some will make a little money by good management; others will just get by, and some will not make the grade. It has reached the stage where good management is the deciding factor. It will not be like it was for a while, when anybody could get into business and get such good prices that he could not keep from making money. Those days are over; and, frankly, we believe it is better for the country that they are over. We hope for gradual betterment in our line, along with other business, and we confidently look for this to come about during the next few years. We have been in business for 20 years and have seen good times and bad times, and we hope to see better again."

Few Obsolete Plants According to Producers Themselves

IT TAKES more than old machinery and equipment to make a plant in the rock products industry obsolete, according to the majority of producers. As long as a plant can turn out a product that finds local use, it may still be counted a competitor. However, tighter specifications in many localities have forced and will continue to force the installation of new equipment in all the industries.

Cement

Almost without exception cement manufacturers believe major efforts the next few years will be devoted to organizing operations to produce less material more efficiently; many of them are already working to that end. One notes that the place and importance of depreciation and obsolescence in cost-keeping have been forgotten the past two years. Another suggests all must be satisfied with efficient operation at 50% capacity.

Cement manufacturers seem convinced that the trend of production for the next five years will be slowly upward; some qualify this by saying they expect little change for at least two years.

Estimates of the amount of obsolescence in the cement industry vary from nothing to 50%; 10% seems to be a popular figure. One says, "with labor and materials so low, plants written off as obsolete are in good condition today, so far as production costs are concerned." Another suggests that to meet present-day competition, the burning of suitable clinker is going to mean great changes in kilns at many plants. One producer states: "Probably 30 to 40% of existing plants cannot make cement of the quality now demanded, at costs in line with present or expected prices; where strategically located they should be rebuilt, probably for smaller outputs." Another suggests that location and percentage of capacity operated are frequently larger elements in cost than differences in modernness of equipment.

Lime—Crushed Stone

Those in the lime industry who have given the subject the most thought believe small units, conservatively and efficiently managed, are faring best and will hold their own. All agree, though, that there are too many lime producers now, and that some will have to drop out. Few hazard a guess what trend production will take; evidently they are reconciled to present business. Most lime manufacturers believe, apparently, that a lime plant is never obsolete. One says: "That is one of the troubles of the lime industry." Only one correspondent sees much ahead; he visions new lime products put on the market in the next five or ten years.

A number of crushed stone producers comment on the "new competition"—the opening up of many new small quarries to avoid transportation costs. Only four see the large centralized operation winning out. A Southwest producer says: "Restricted credits will force innumerable bankruptcies and tend to create centralization and permanent elimination of many plants, with resulting decrease in present overcapacity and final improvement to the industry for those who survive the next few years." A Nebraska operator reports: "With the railways reducing freight rates to meet truck competition, and with trucks hauling at starvation prices, it looks as though the well equipped large plant might take practically all the business." A Missouri producer thinks the trend will be toward large scale operations and consolidations. A Pennsylvania producer, in a section particularly infested by small, temporary competitors, says he believes these smaller units will be crowded out because their production costs are too high; this has happened in his locality.

Many more operators, however, see the small local operation with the advantage: Various comments are: "Trucks and cheap power (Diesel engines) make possible opening up new deposits; large operations can no longer reach wide markets"; "the way present plants are built, small amounts of material cannot be produced more efficiently than at present—every plant economy we have put into effect is more than offset by the inherent expense of reduced output"; "unless some curb is placed on trucking, the general trend will be toward more and smaller plants, and except in areas adjacent to large markets, the day of the large plant is over"; "the small, local, efficient plant is best, large plants cannot operate efficiently at greatly reduced volume"; "present tendency is to install small, cheap plants as close to point of use as possible to avoid freight—expect the lowering of freight rates to counteract this tendency, as carriers are as much losers as producers." A Pennsylvania producer expresses the opinion that if the present type of road is built (bituminous macadam) and the contractor allowed to use local stone, the trend undoubtedly will be toward compact, efficient portable plants, or semi-portable plants." A New York producer says: "The centralized large unit is doomed; smaller efficient units, geographically distributed to serve local markets, are what is called for."

The editor's belief, based on a study of these and many other opinions, is that while present conditions undoubtedly favor the small local plant in many instances, this is not necessarily a permanent condition. Probably some day quarrying will be better supervised and regulated by governmental authorities and opening up quarries at any old place along a road will not be permitted; and certainly the time will come when anybody without experience, financially irresponsible for accidents, will not be permitted to operate a quarry. Moreover, the railways will in the course of time be compelled to help the established producer; and possibly some regulation of trucks, or particularly of trucking rates, will prove that truck hauling is not so cheap after all.

Apparently the majority of crushed stone producers do not consider a plant obsolete as long as it can crush and screen stone. They do wear out, though, and according to the best advice must be entirely revamped every 10 years to stay in the running. One producer says the whole industry "has liquidated its equipment beyond all reason." Another is specific: "Our own plants have been rebuilt, with the result that other local plants are obsolete and will be unable to compete unless they do likewise." Another producer, who is known to have made many improvements recently, remarks: "I feel that at least 50% of the plants are obsolete and the owners do not know what is the matter with them." The few who estimate the percentage of obsolete plants in the industry as a whole vary from 1% to 80%—take your choice!

Sand and Gravel

The sand and gravel industry has one Moses—an Ohio operator—who has "taken the position of selling only to those jobs where he can make a profit and producing materials his competitors have not." This policy is succeeding so well that he will install a new Diesel-engine generator to make his own power and thus cut down the heavy demand charge—and he looks for the next five years to be dull!

The problem of local pit competition is summarized by a Michigan producer as follows: "Lower freight rates and new means of transportation are increasing the sphere of all operations. This will make for survival (1) of large strong operators who can purchase to advantage and keep their plants up to date, and (2) small operators without overhead, depending entirely on local markets; there is no reason for any other class of producer." Several others emphasize the opportunity today for the smaller operator—not necessarily the moveable plant operator, but the one with small overhead and close personal supervision. Only one of about 100 producers reporting suggests the desirability of operating portable plants to supplement

established operations. Another Michigan producer summarizes as follows: "Road programs will slow up because of diversion of highway funds; believe medium sized plants will organize to produce better products more efficiently; a good many small plants will fall by the wayside; and the very large plants will have a hard time because of excessive carrying charges."

While the majority see few obsolete plants in the sand and gravel industry, many see the need of much new equipment "to organize the average plant" to accomplish what the Michigan producer just quoted says is the solution of the industry's problems. Where more rigid specifications have recently been introduced producers agree that upward of 50% of the local plants have been rendered obsolete. Others believe that too large size has rendered numerous plants obsolete. One Indiana producer goes so far as to say "under present conditions all plants depending on rail transportation for distribution are obsolete."

Gypsum

In the gypsum products industry producers believe economic conditions rather than lack of equipment have rendered some plants obsolete. Almost unanimously they look for an upturn in production.

Miscellaneous

Other reports include producers of slag, feldspar, slate, phosphate, talc, silica, rock asphalt, sand-lime brick, concrete products, and special products such as whiting. A New York talc producer offers the following: "No one is going to revamp mills without something to do it with; we will not produce more than needed if we quit gambling and go to work; the advice is still good 'if something is offered you for nothing call for the police.'" A producer of a silica product says: "Believe the era of concentration and expansion of facilities of a few large operators is over, and our major effort for the next few years will be in utilizing more widely distributed and smaller operations to produce less materials more efficiently, with the prime purpose of reducing distribution costs; moreover, experience has shown consumers and distributors can operate on lower inventories." Another silica producer says: "In many lines the merger of plants and facilities has not brought about expected economies and efficiency—in fact in many instances it has created a cumbersome, unwieldy organization." Another: "Efficiency in small plant operation will be the order of the day for many years." A concrete products producer suggests: "Produce only what can be sold at a profit and organize accordingly." A producer of special aggregates gives this good advice: "Every business should stand on its own feet; it is a mistaken idea that there is a method, taking a whole industry, that will curtail production in an honest way; profits and losses will curtail production; the small operation well managed has the advantage." Talc producers agree that at least 50% of the mills in that industry are obsolete. A silica producer says not many plants in that industry are obsolete; that if the present trend continues it may be more economical to do more hand work and reduce the investment in machinery; while this looks like a step backward, nevertheless self-preservation is nature's first law." A tripoli producer states that improved methods and equipment developed during the last three years have rendered nearly all plants in this industry obsolete.

Engineering Opinion

The returns include several opinions from engineers closely associated with the rock products industries. One, who is responsible for the purchase of much highway material, says: "Expect producers to assume more responsibility for uniform materials in order to overcome control problems that are not efficiently handled in the field." Another: "Improved efficiency will be brought about slowly; too many producers still have some ways to go before high cost operators will be forced out; in the meantime there is little incentive to make plant improvements." Some other comments are: "Large crushed stone plants are unnecessary; the future will see more small ones, well distributed"; another predicts breaking up the larger operations into smaller groups; another, closely identified with the cement, lime and gypsum industries, sees a tendency toward diversification, supplying new and better materials to bring about a gradual evolution in building materials and methods." A man quite familiar with all the rock products industries remarks: "Everybody simply has to work out his own problem; the future will take care of the worker, be he laborer or business man."

The engineers are not so blind to obsolescence; one on the Pacific Coast says: "Almost every plant on the Coast is obsolete in some respects; producers who have cooperated with the state have made some effort to rehabilitate, but this work is just started." An engineer in Iowa says a recent development in shale removal has rendered at least half the sand and gravel plants in northern Iowa obsolete.

Stone Screenings as Blanket Under Macadam

TO DETERMINE the value of stone screenings as a blanket layer under macadam, tests have been conducted in the laboratory of the National Crushed Stone Association and were reported by A. T. Goldbeck in a recent issue of the *Crushed Stone Journal*.

The use of stone screenings as a blanket has been considered for soil conditions where displacement of the sub-grade material upon which the macadam surface was placed intermingles with the stone, acting as a lubricating agent, thus decreasing the supporting value of the stone layer. The layer of stone screenings prevents the upward intrusion of the subgrade material into the voids in the stone.

By means of a specially designed testing track various types of subgrade material were tested and it was determined that when a macadam road was built on a clay subgrade it would be a wise precaution to use a blanket course of screenings before laying the coarse stone. One to two inches should be sufficient for this purpose. When the subgrade is composed of extremely finely divided sand a layer of screenings in this thickness will not be efficacious.

Investigations of Bureau of Standards

AMONG investigations carried out by the Bureau of Standards during the fiscal year ending June 30, 1932, were a continuation of an investigation of the physical properties of mortars and bricks and of the durability of the bond of brick to mortar; a study of the basic chemical problems of the cement industry; the influence of composition on the qualities of the resulting cements; strength and volume changes of high early strength cements for different water-cement ratios; physical properties of masonry cements; physical properties of cinder aggregates for concrete from various sources; cement reference laboratory inspection; inspection of cement for government projects; methods for determining purity of gypsum plaster and sand content of set gypsum plaster were developed, as well as for preparing calcium sulphate and its hydrates of high purity; a proposed Federal specification for Keene's cement was prepared; a number of papers on properties and uses of nonmetallic minerals have been published and work on building code requirements and building and housing problems have been carried out. Fire tests of partitions and gypsum column protection were also made. These tests, and others conducted by the Bureau during its last fiscal period, are listed in its annual report.

White Cement Closes Soon After Opening

THE National Portland Cement Co.'s white cement plant at Chubbuck, Calif., has closed.

F. W. Fahrenkamp of El Paso, Tex., with two other stockholders made a trip to the plant following reports that the plant was producing cement.

Mr. Fahrenkamp said he was planning to call a meeting of El Paso stockholders to advise them of the plant's condition.

"The plant operated for a short time, and produced a small amount of white cement," Mr. Fahrenkamp said.—*El Paso* (Tex.) *Herald-Post*.

Obsolescence in the Sand and Gravel Industry

By Earl C. Harsh

THE constant growth of more strict specifications and the striving for greater production efficiency and economy have resulted in many changes in plant operation. While some plants have gone forward and adopted improved methods and equipment, others have failed to do so and are now struggling to meet the competition of those that have kept abreast of the times.

In some cases these changes have been made by adding to the existing plants, making them more complicated and with a multiplicity of units, thus losing in increased cost of production part of the benefits from the making of improved products, while in others, particularly in the case of new plants, simplification of units has been obtained.

In the plant itself there has been a greater use of steel and concrete instead of wood construction, better washing and sizing equipment, more efficient crushers, modern drives to replace open gearing and belts, and a greatly increased use of anti-friction bearings. There has also been an increased use of mixing belts to obtain any desired size gradation, and final rinsing of the product at the point of shipment.

Along with these things there has developed a greater use of trucks in place of industrial railroads in dry operations to transport the material from the pit to the plant, and a greater use of storage facilities to better coordinate plant operation with shipments.

In order to bring out more clearly these differences in methods and equipment, a brief outline will be given of what is now generally considered to be good practice.

Pit Operation—Excavating and Transporting

Centrifugal pumps in sizes from 10 in. up have proved satisfactory for excavating where the deposits are below water and for transporting the materials to the plant when the distance is not too great. However, when the material must be transported any considerable distance and elevated very high, other methods of transporting and elevating are generally more economical. Draglines in connection with cars have also been found satisfactory at many plants.

Where the deposit is above the water level power shovels have been found most satisfactory for operations of any considerable size. The advantages of crawler type shovels over the old railroad type and of electric shovels over steam shovels have been quite fully demonstrated.

For small operations the cableway and drag scraper has been used successfully. The method and equipment to be used in any given case depend, of course, upon the particular conditions.

Plant Operation—Washing and Screening

Perhaps the most noticeable changes in plant operation are the greater use of scrubbers, the increased use of vibrating screens instead of revolving screens, and the increased use of sand classifying devices.

Whether scrubbing should be done before or after screening depends upon the material. The revolving drum type of scrubber is generally used ahead of the screening operation and the screw or log washer after. Equipment of this type is necessary if much clay is present in the material, as it is much more readily removed in this way than by revolving or vibrating screens.

Of the two types of screens, the revolving screen does a better job of washing than the vibrating screen, particularly on coarse material, but the vibrating screen can be used to advantage where the material is fairly clean and for the smaller sizes. The best arrangement, generally speaking, is to use both, dividing at ½- or ¾-in. size and using revolving screens for the screening of the coarse material because of the better washing effect and vibrating screens for the fine material because of the better sizing.

In the washing process considerable improvement has been made in the method of applying the water. Improved jets permit a better application of the water to the material, use less water and do not clog. These have spoon- or fan-shaped deflectors which give a thin sheet of water, better distributed than that from ordinary homemade jets. Also, the use of a ½-in. hole instead of a small opening very much reduces any clogging of the openings.

For recrushing the material down to smaller sizes, the new cone type crusher and high speed gyratory crusher accomplish this more economically than the older types. Improved performance has also been obtained from old type gyratory crushers by equipping them with the new type curved heads and concaves.

In the production of sand, improved classifiers such as the controlled rising current type and others have made it possible to positively and economically control the grading of the sand to meet present specifications. Ordinary settling tanks such as were formerly widely used do not control the grading to any appreciable extent, and also let dirty water through with the product. Where partly dry sand is wanted direct from the plant, as for city truck delivery, a dewatering screw or drag flight conveyor is desirable to remove the excess moisture.

Except where perforated-bucket dewatering elevators are used, and where the layout will permit, belt conveyors have almost entirely superseded bucket elevators, having been found more economical and satisfactory. Anti-friction bearings have largely superseded the old plain bearings on all equipment, principally because of the savings in maintenance labor and power.

Another change in method has been the more general use of a mixing belt between the bins and the loading-out point, so that any mixture of sizes may be made. This method, where the material is separated into certain sizes for bin storage and then recombined, makes it easier to turn out a product of any desired size gradation to meet any specification.

Rinsing of the product over a small vibrating screen at the loading point, as is now being done at a number of plants, helps very materially in the delivery of a clean product. Even though thoroughly washed prior to going into the bins, a certain amount of dirty water stays with the material, so that as drawn from the bins it does not have a clean appearance. While the actual amount of impurities and foreign matter may be very small indeed, the appearance may be all against it, so that the additional rinsing is fully justified in many cases.

Storage facilities have become of greater importance to many operators than formerly. While the rehandling of the product adds to its cost, there are certain advantages resulting from ample storage facilities. More particularly, the plant with ample storage need not shut down intermittently because of temporary stoppage of orders by contractors, and is in a position to ship larger orders when called for to compensate for such stoppage.

Plant operations can thus be equalized and kept on the most economical basis, and in the case of new plants it is quite feasible to design the plant with smaller units than would otherwise be required. Thus such factors as first cost, operating power and labor cost, demand charge when power is purchased, etc., may be reduced.

The extent to which a plant has been kept up to date indicates the degree in which it may be considered modern or obsolete. Only by using modern economical methods can a plant survive and show a profit.

Sound Advice from Iowa Gravel Producer

FROM the most downcast of the argicultural states, Iowa, comes the following note of optimism: "We are certain business is on the upward trend. It will be slow because of the declining price trend. We believe every man should go after what business he can get; be patient; industrious, and use his head mightily. There is business to get. Reduce costs as much as possible."

Facts About "Overhead"

THE EDITOR is indebted to a friend in the industry for the following thoughts: The overhead item in cost of production may be roughly divided into four parts — (1) salaries, selling and administrative expense, (2) depreciation, (3) obsolescence, (4) interest and taxes. Perhaps we might for a moment consider them separately.

There is no question that salaries, selling and administrative costs have been drastically cut. As to salaries, anyone familiar with the situation knows that, like the old gray mare, "they ain't what they used to be." Selling has admittedly cost too much. There has been extravagance in entertaining. There is a lot of useless expense involved in having 20 salesmen at a letting where only one could get the business. Elaborate suites of offices in new buildings cost money, and probably have been expanded beyond actual needs. Contraction has been pretty sharp in these items, *but* have they been contracted 50% in line with current production, and can they be so contracted?

Depreciation is a charge that, from one viewpoint, is the cost of wearing out a machine in service. But that is too narrow an interpretation of the term. A boiler usually depreciates more rapidly when standing idle than when it is in use. Belting deteriorates even in storage. The insulation in motors and other electrical equipment diminishes in effectiveness whether the apparatus is in use or not. In its larger aspect, depreciation is a function of time rather than of production, and should be taken as a percentage of first cost expressed in dollars per year, not in cents per barrel, or per ton.

Obsolescence is an expression of the fact that equipment gradually becomes out of date. It does this whether it runs or not. A whole industry may become obsolete, as has happened to several in the last few decades. The manufacture of portland cement may become obsolete if something better is discovered to take its place. Any certain machine or type of machine becomes obsolete if another is developed that will do its work cheaper and better, or will give a product that is more in demand. Short kilns, Griffin mills and Fuller mills were once important features of our cement plants, but they are now practically obsolete. Obsolescence, then, is also a function of time rather than of production, and runs on whether the equipment to which it is applied is used or not. It also should be taken as a percentage of first cost in dollars per year, not in cents per barrel, or per ton.

If a company has borrowed money, either by the sale of bonds or as temporary loans for working capital, it must pay interest. If it fails to do so, and has no understanding with its creditors, it goes through a reorganization. Taxes are just as inevitable. They have to be paid. And neither interest nor taxes have more than a remote connection with production. They run on whether the plant runs or not.

These things then seem to be true:

(1) Salaries, selling and administrative expense can be reduced, but only to a limited extent if the company wishes to stay in business and be reasonably well managed and operated.

(2) Depreciation and obsolescence, being taken at a certain fraction of the plant cost per year, will in time amount to the entire first cost of the plant. When this time arrives, there will be no good reason for further continuing these charges, *but the reserve set aside to care for them should be maintained as actual cash or liquid assets.* If this is not done, the time will arrive when the plant becomes so run down and obsolete that it can no longer be operated profitably, and there will be no money on hand to replace it.

(3) Interest must be paid regardless of production, unless the indebtedness is retired and no new one created.

(4) Taxes are even more unavoidable than interest, for they run as long as the property has taxable value.

(5) And most important — all of these things are, in the last analysis, charges against time rather than against production. They amount to a certain number of dollars per year, no matter how much or how little cement, or what have you, is made. Then, using cement as an example, if production is cut in half, each barrel must bear as an essential part of its cost of manufacture twice its previous burden of overhead expense in actual money. If this expense is not included in the cost of manufacture, disaster will in time overtake the company, for this expense is just as real as the cost of fuel or labor. It follows then that the selling price of cement made on a 50% production basis must be higher than when made on 100% production basis if the manufacturer is to come out even, not to speak about making a profit. The only alternative is to get such a high price in boom times that enough overhead can be charged to offset its omission during depression. Then the question is, is this overhead properly charged and set aside, or is it paid out in dividends?

Probably in times past with the best managed companies the overhead charged against the cost of production was in some good measure converted into cash or liquid assets to be used for plant replacements on account of obsolescence. It is largely on these assets that these organizations have been living the past year or two. Where this has been done these companies can no longer say they can make cement at a lower cost than the new mills because they have already charged off the entire cost of their mills. Their reserves for replacements must again be built up, or they are headed for certain disaster.

Lime Manufacturer's Cure for the Depression

A NEW ENGLAND lime manufacturer offers the following: "The only cures for this depression are (1) a national law for a universal shorter week to spread employment. This should be flexible and based on 80% employment. As times get better and more man-hours are needed the working week law can be amended to add a day, and kept there until the 80% level has been reached again, etc. (2) Taxes must be reduced. Honest men must be in power; make politics unprofitable for the politician or crook, and they will get out. Reduce political salaries. Make them pay income taxes. Employ welfare men to do public work and pay them in food. (3) More men must go back to the farms and get their living from the soil. They must reverse the flow of the last 20 years—too much congestion in cities."

Success Up to Individual

A PROMINENT gypsum products manufacturer offers the following: "I do not look for any improvement in sales or tonnage; but I think we have learned valuable lessons in regard to economy of operations generally. Like most years, 1933 will probably have a reward for hard work and intelligent planning. I think the outcome is as much a question of the individual as it is of business conditions."

Over-Competition Must Be Over-Come

AN EXECUTIVE of one of the large crushed-stone organizations makes the following suggestion: "It is time that people generally realize that over-competition is as dangerous as monopoly. Conditions will not improve sufficiently to eliminate distress until a minimum wage, reduction of working hours, enforced cooperation through trade associations and prohibition of selling at a loss are established."

Wanted—Dewatering Devices for Sand and Gravel

AN ILLINOIS sand and gravel producer writes: "There is a marked need, in view of the increasing use of trucks for shipments direct from plants to jobs, for dewatering devices, so that aggregates can be delivered to the truck as free from moisture as possible—conforming to the demands of engineers."

Demand for Better Products and Competition Make Obsolescence in the Crushed Stone Industry

By Melvin C. Dow

THERE IS sometimes a confusion as to the meaning of the terms depreciation and obsolescence. A machine is fully depreciated when it has fulfilled its expected life. It is obsolete when it is out-of-date because of new improvements making for more economical operation. Of course a machine may be fully depreciated and obsolete at the same time, although more often it becomes obsolete before it is fully depreciated. Generally speaking, then, depreciation deals with the physical aspect, obsolescence with the economic.

One should avoid being too dogmatic in labeling a machine or a method as obsolete, especially in the stone crushing industry where every plant presents its own individual problems. The best we can hope to do is to point out the general tendencies in making new installations, always remembering that there are exceptions to these tendencies.

The recent developments which are the cause of obsolescence in the stone crushing industry are largely dependent on two factors. The increased knowledge in the manufacture of concrete has caused a demand for a better sized and conditioned product, while the pressure of competition has increased the necessity of effecting operating economies that were not considered a few years ago. With these facts in mind let us look over some of the trends in the modern stone crushing plant.

Drilling and Blasting

In large open face quarrying operations the well drill is universally used for drilling except where tunnel blasting has proven more economical. The latest developments in the well drills themselves are steel masts, steel cables, and heavier drilling tools. These new machines are of exceptionally rugged construction, with roller bearings and all steel parts. With the heavier tools it is not only possible to drill faster than before, but these drills can smash through seamy rock that with lighter tools would mean another "lost" hole. Although there have been many difficulties to overcome in the development of the steel rig, and although the machine is not quite out of the experimental stage, some quarry operators are of the opinion that it will entirely replace other types.

Today modern dynamite and blasting gelatins have entirely taken the place of the black powder used in the early days of the industry. Where conditions permit, large blasts of these modern explosives are used today. The improvement in these explosives has advanced with the industry so that at present their effectiveness and safety are greater than they were even a few years ago.

In secondary blasting the old method of mud capping is too costly in the modern quarry and jackhammer drills of improved design are used to drill the blocks. Dynamite is used to break the blocks and while hand ignited fuse is still used to some extent, the modern method is to use a blasting machine for these shots. In the blacksmith shop the new automatic heaters and sharpeners have made obsolete the old method of hand sharpening bits and drills.

Quarry Loading

When the stone industry was young the hand loading of stone into small cars was the general method. Since then power shovels have been developed and improved until today the latest development in this field is the electric and Diesel-electric shovel. While the steam shovel is by no means obsolete, the use of the electric shovel in stone quarries has grown considerably since it was introduced some six years ago. The advantages of the electric shovel, besides its smooth operating characteristics, are that no water lines (a constant source of trouble for the quarry foreman) are needed, coal does not have to be hauled to the shovel, and no watchman is necessary to keep up the fires at night. While an electric cable is required, its flexibility makes it comparatively easy to handle. The new Diesel-electric shovels, with similar characteristics and advantages, are being used where the construction of a power line is too costly or where fuel costs warrant their adoption. Diesel engines themselves are replacing older types of prime movers in plants where power is generated. In connection with the shovels might be mentioned the new improved removable and reversible manganese dipper teeth which because of their high percentage of wear have made obsolete the earlier designs of removable teeth.

Quarry Haulage

Many in the stone industry today can remember when horse or mule drawn cars were used to haul stone from the quarry to the crusher. A later method was to pull the cars by means of a steel cable connected to a steam hoist near the crusher. Then came steam and gasoline locomotives, motor trucks and electric haulage systems. Of late years the motor truck has come into greater use and though it has not by any means made obsolete the use of locomotives and cars, it has limited their field of application by proving to be more economical for short hauls. Locomotives and cars are best where the hauls are long and where the grades are too steep for other systems. Where the quarry face is long and where the size of the blasts are not limited the electric haulage system has a great advantage, but for hauls of not more than 2000 ft. motor trucks seem to be taking the place of other haulage methods.

Crushing and Screening

The earlier crushers were of the jaw type, followed by the gyratory crushers, which showed certain advantages over the jaw type, especially for secondary or reduction crushing. For primary crushing, however, since it is generally the size of the shovel dipper rather than the capacity of the crusher that governs the selection of the crusher, the jaw type has some advantages because for the same initial cost this type of crusher will take a larger stone than the gyratory. Double roll crushers have been used as primary breakers, but their application has been somewhat limited.

For secondary or reduction crushing the gyratory has long been the favorite type. Its inherent disadvantages of relatively low ratio of reduction and limited capacity are making the old machines obsolete, however, when compared with the modern cone type which has all the qualities that the old gyratories lacked. These modern crushers are exceptionally rugged in construction, have a large ratio of reduction, large capacity and consume less power. One disadvantage to this type is that its parallel sides have a tendency to pass slabs in certain kinds of rock, but this disadvantage is offset by its many good points. The manufacturers of the older types of gyratories are now furnishing special curved concaves and heads for these machines which very materially increase their capacity and ratio of reduction by approximating the principle used in the cone type.

Scalping has been accomplished in the past by revolving screens. These machines, however, have always occupied much space and consumed much power for the amount of useful work done. One has but to look at a revolving screen in action to realize that much machinery is being turned over for the amount of stone being screened. To overcome some of these disadvantages live-roll grizzlies were developed, but both the revolving screen and the roll grizzly are today being replaced by the modern rugged vibrating or gyrating screen. The advantages of

the vibrating or gyrating screen are its greater efficiency, smaller power consumption, lower maintenance and smaller space occupied.

For sizing screening the same advantages hold for the vibrating screen as in scalping. A particular advantage with these screens is the relative ease with which screen cloths can be changed or replaced. In making the smaller sizes of commercial stone slightly different vibrating screens are used, but all of these modern screens have made obsolete the older types. The gravity screen as formerly used in sizing stone is obsolete because of its inefficiency and because of the additional power and equipment needed to elevate the material fed to the screen.

Elevating and Conveying

The two principal methods used in elevating and conveying crushed stone are belt conveyors and bucket elevators. Where space is limited it is still necessary to use bucket elevators, but when there is a choice between the two in a permanent installation, the belt conveyor is more economical. Since the first belt conveyors were installed, conveyor idlers have been steadily improved so that today on all important installations the modern sturdy idlers with anti-friction bearings have replaced the plain bearing type. Although the anti-friction idlers show the greatest percentage of power saving in long level conveyors, their lower maintenance cost, lubricant saving and dependability warrant their use on inclined conveyors as well. In many cases the first cost alone will be less for a conveyor with anti-friction idlers due to the saving in belt plies.

Power Transmission

The modern tendency in all drives is toward simplicity, with individual motors for each unit, eliminating line shafting, belts and pulleys, chains and sprockets, and spur gears. Where the speed of a unit is the same as a standard motor speed, the usual method is to connect the motor directly through a flexible coupling as in the case of a centrifugal pump or cone crusher. Where a direct connection is not practicable, or where a variation from the motor speed is required, the short-center "V" rope drives are used as on vibrating screens. Where a slow speed drive is required, or a greater variation from the motor speed, a speed reducer is used, direct-connected to the motor through flexible couplings. These modern drives not only show a considerable power saving, but their lower maintenance and insurance against breakdowns is a great advantage.

When individual drives were first installed on crushing, screening and conveying equipment the fact was overlooked that when one operation stopped and another did not, considerable trouble might be caused by chutes choking and stone overflowing the conveyors. This was overcome by installing a system of electrical interlocking so that if one machine stopped those feeding to it would also stop. This system works very well, but in the modern plant surge bins have also been provided so that a short interruption in one operation will not affect the production of the plant.

General

In addition to the improvements made in the equipment itself there have been developments affecting the design of the plant as a whole. More rigid specifications for certain mixtures of sized stone have called for other methods of loading out the product than spouting it direct from the bins to railroad cars or trucks. This loading out has been done in some cases by combining the required sizes on a so-called mixing belt conveyor which has called for close control of the rate of feed from each bin. Thus other types of gates, more easily adjustable to give the exact quantity desired, have been gaining in favor over the old duplex gate.

In the handling of sized material, more attention has been given to the prevention of segregation and breakage of the stone and means taken by the use of stone ladders to reduce breakage and by specially designed chutes to reduce segregation. Another factor affecting the flow sheet of the modern plant which has to be reckoned with is the varying market demand. This has been met by the use of suitable storage systems and some plants have arranged the storage so that previously sized material can be recrushed to smaller sizes.

In some sections of the country it has lately become necessary to wash the crushed stone in order to satisfy certain specifications so that the old methods have become obsolete and have had to be changed. One of the latest developments in the stone crushing industry is the manufacture of stone sand from the waste screenings, thus reducing the amount of material which must be handled to waste piles. This is a good illustration of how a loss has been changed into a profit and a new market created.

Comparative Costs of Quarrying for Cement, Lime and Crushed Stone

THE United States Bureau of the Census has recently made available to interested editors proof sheets of the forthcoming report on Quarrying. The figures cover the year 1929 and are therefore largely of historical interest only, except for comparative purposes. It would be interesting to know if in 1932 the same differentials exist between costs in the three industries.

Cement Producers

According to the Census figures, 40,274,599 tons of limestone and cement rock were quarried by cement producers in 1929.

Reducing the cost figures which the Census Bureau reports for quarrying to a cost per ton basis, we find the following:

Cost of wages	$0.18 per ton
Cost of supplies	0.10 per ton
Cost of fuel	0.01 per ton
Cost of purchased electric energy	0.018 per ton

* * *

Combined cost of supplies, fuel and electric energy	$0.13 per ton

* * *

Total value of limestone and cement rock quarried by cement manufacturers	$17,784,974

* * *

Value of limestone and cement rock used in manufacture of cement	$15,592,369 = 87.68%
Value of limestone and cement rock sold as raw material	2,050,979 = 11.53%
Value — used in other products	141,626 = 0.79%
	100.00%

Lime Producers

Limestone quarried by lime producers in 1929 totaled 17,370,167 tons. Various production costs figured on a tonnage basis were as follows:

Cost of wages	$0.30 per ton
Cost of supplies	0.12 per ton
Cost of fuel	0.02 per ton
Cost of purchased electric energy	0.04 per ton

* * *

Combined supply, fuel and electric energy	0.18 per ton
Total value of limestone quarried by lime manufacturers	$13,247,023

* * *

Value of limestone used for lime	7,094,003 = 53.55%
Value of limestone sold as raw material	6,139,293 = 46.34%
Value of limestone used in other products	13,727 = 0.11%
	100.00%

Crushed Stone Producers

Crushed stone producers produced 102,960,312 tons of crushed stone in 1929, according to Bureau of the Census reports, at a total value of $99,627,502. Production costs figure as follows:

Cost of wages	$0.28 per ton
Cost of supplies	0.17 per ton
Cost of fuel	0.03 per ton
Cost of purchased electric energy	0.04 per ton
Combined cost of fuel, supplies, electric energy	0.25 per ton

Comparative Cost of Labor

Further investigation into the cost of wages for quarrying in cement, lime and crushed stone industries gives us the information below:

Industry	Tons produced per wage earner	Value per ton	% of value which goes to wages
Cement	7439	$0.44	41%
Lime	3761	0.76	39%
Crushed stone	4263	0.97	29%

Do Production Costs Mean Anything in a Year Like This?

A Mistaken Idea That Volume Is the Sole Criterion of Costs

By S. E. Honey
Stewart Sand and Material Co., Kansas City, Mo.

"PRODUCTION COSTS don't mean much this year," was a remark overheard at a recent meeting of crushed stone producers. "They don't mean much," the spokesman continued, "because the low volume of business at which most plants are being operated necessarily results in a higher unit cost than in former years, which makes an accurate comparison impossible."

The spokesman was partly right and partly wrong. It is true that most plants are being operated on a lower volume of business this year than in former years. It is also true that as a rule, a lower volume of business results in a higher unit cost. It is not true, however, that an accurate comparison of costs cannot be made because of reduced production.

With proper analysis of cost figures it is frequently found that an increase in the unit cost of production really represents a marked improvement in the methods of operation when the effect of the reduced volume is properly measured. Without such an analysis, the producer has lost his ability to measure the value of economies put into operation and the plant management has lost the stimulus of having any measure of real accomplishment.

When an attempt is made to make a direct comparison of production costs between two periods, one finds that, due to variation in production, it is difficult to make an intelligent and satisfactory analysis. After making a study of the individual items of cost, one finds that comparison is difficult because some costs vary in direct, or in almost direct proportion to production, some are practically fixed, while others are partly fixed and partly variable. Therefore, in order to make an accurate analysis, it would seem necessary to reduce the costs to some common basis so that comparison could be made regardless of the variation in production. The method used by this company is to break down all items of cost into fixed and variable classifications. This is done by analyzing each expense account and determining whether it is a variable cost, fixed cost or a combination of the two.

Classification of Expenses

A brief outline of the method used in classifying our expense accounts will probably prove helpful. All repetitive operations on which men are paid on an hourly or tonnage basis are classified as variable costs because the total labor cost does vary in almost direct proportion to production. Power cost is classified as partly fixed and partly variable in as much as the demand cost is fixed, while the energy charge is variable. Such costs as supervision, insurance, etc., are classified as fixed costs because as a rule they remain practically stationary. Maintenance cost is considered as being partly fixed and partly variable. It is our policy to do major overhaul work during the winter season. This cost is fixed because, regardless of the amount of production the following year, a fixed amount has been spent. After the major overhaul work has been completed, all maintenance is classified as variable cost, on the theory that this cost for the rest of the year will be about in direct proportion to the tonnage produced. Our experience indicates that while there will be some variation from month to month, yet for the year it is substantially correct.

Introduction

***THE EDITOR:** I remembered our conversation about cost of operation, and I was reminded of it again when you and I heard a crushed stone producer say there would be no attempt made to work on a standard cost accounting system this year because costs were necessarily running higher due to smaller volume, and so comparisons would not be valuable.*

Mr. Honey is an accountant who has been with us for some years, and developed and applies both our cost accounting and our budget system.

As I look back on it now, I do not see how we could have kept business right side up during the past year or two without the information given us by our budget analysis. This is kept up promptly each month, and our several superintendents have become so interested that they are constantly checking their actual costs against the budget. It has further enabled us to know exactly the results to be obtained by shutting down plants and other steps we had to take to meet the rapidly decreasing volume of business offered.

JOHN PRINCE,
President, Stewart Sand and Material Co.

COMPARATIVE PLANT PRODUCTION COSTS (HYPOTHETICAL)—SCHEDULE I

Mining	Six months 1932	Cost per ton	Six months 1931	Cost per ton
Labor drilling and shooting	$ 3,720	$0.062	$ 6,400	$0.064
Explosives	4,200	.070	6,800	.068
Labor loading	900	.015	1,600	.016
Labor hauling	660	.011	1,200	.012
Trucking cost	2,000	.033	3,700	.037
Repair labor	1,720	.029	2,500	.025
Repair materials	2,100	.035	3,200	.032
Miscellaneous mine labor	1,980	.033	2,900	.029
Miscellaneous mine supplies	1,020	.017	1,600	.016
Total mining cost	$18,300	$0.305	$29,900	$0.299
Crushing and screening				
Labor	900	.015	1,600	.016
Repair labor	1,100	.018	2,200	.022
Repair materials	1,600	.027	2,900	.029
Total crushing and screening cost	$ 3,600	$0.060	$ 6,700	$0.067
Storing and reclaiming				
Labor	1,920	.032	3,100	.031
Trucking cost	2,220	.037	3,500	.035
Repair labor	300	.005	400	.004
Repair materials	420	.007	500	.005
Total storing and reclaiming cost	$ 4,860	$0.081	$ 7,500	$0.075
Shipping				
Labor	1,140	.019	1,900	.019
Repairs	120	.002	400	.004
Miscellaneous expense	.....	.....	.....	.....
Total shipping cost	$ 1,260	$0.021	$ 2,300	$0.023
Undistributed plant costs				
Power	5,400	.090	6,700	.067
Miscellaneous plant expense	360	.006	390	.004
Supervision	3,900	.065	4,800	.048
Miscellaneous plant labor	1,200	.020	1,200	.012
Rent and royalty	2,400	.040	3,200	.032
Insurance	780	.013	780	.008
Compensation insurance	1,080	.018	2,000	.020
Total undistributed plant cost	$15,120	$0.252	$19,070	$0.191
Total production cost	$43,140	$0.719	$65,470	$0.655
Tons produced	60,000		100,000	

In order to illustrate the details of this method, let us take the following hypothetical set of cost figures and analyze them.

The schedule of distribution of cost, but not the value set out, is based on those used at one of our crushed stone plants. In this plant the limestone is produced by mining. The rooms are of sufficient size to permit loading by use of electric shovels. As the mine is entered from the side of the hill, the haulage from shovel to plant is accomplished by large trucks. Otherwise the operation is not different from many other crushed stone plants.

In Schedule I we have a cost statement comparing the costs for the first half of 1932 with the same period of 1931. The total cost for 1932 is $43,140 or $0.719 per ton as compared with a cost of $65,470 or $0.655 per ton for 1931. Production decreased from 100,000 tons in 1931 to 60,000 tons in 1932, or a decrease of 40%. Unit cost increased $0.064 per ton, or approximately 10%. With a decrease of 40% in production it seems that an increase in unit cost of only 10% is a favorable showing. But we are trying to find out whether the 1932 costs are higher or lower than the 1931 costs, taking into consideration the variation in tonnage, and unless we can determine this, the value of these cost statements for comparative purposes is largely lost. In other words, we are going to have to determine what the 1931 costs would have been had the production been the same as in 1932.

In Schedule II we have an analysis of the fixed and variable costs for both periods. It will be noted that some costs are variable, some fixed and some both fixed and variable. That portion of repair labor and material and trucking cost which is classified as fixed cost represents the cost of major overhaul work which was done during the winter season, while the part that is classified as variable, is the maintenance during the operating season. Miscellaneous mine labor is partly fixed and partly variable because, regardless of the rate of production, a minimum number of men is required. If production increases beyond a certain point, however, additional men are necessary and it is this additional cost that is considered variable. The same theory applies to the division of Miscellaneous mine supplies. Power costs, of course, is both fixed and variable, in as much as the demand charge is fixed while the energy cost is variable. Supervision, miscellaneous plant labor and insurance are classified as fixed costs. Rent and royalty are both fixed and variable. In this case the rental charge is fixed at $200 per month while the royalty charge is $0.02 per ton of stone produced.

How Costs Are Compared

After having analyzed the costs for both periods into fixed and variable costs, we find that during the first half of 1932 the variable cost was $0.445 per ton as compared with a variable cost of $0.447 per ton for the same period in 1931. The fixed cost during 1932 amounted to $16,440 as compared with a fixed cost of $20,770 for the first half of 1931. Thus while no reduction in variable cost has been accomplished, this cost is no higher in spite of the decrease in volume. The fixed costs have been reduced from $20,770 for 1931 to $16,440 for 1932, which is a saving of over $700 per month. This is a real accomplishment which in Schedule I is concealed in the increase in unit cost from $0.655 to $0.719 per ton. With this analysis available, as shown on Schedule II, it is an easy matter to determine what the 1931 costs would have been had the production been 60,000 tons or the same as in 1932. The total cost on this volume of production would be computed as follows:

Fixed cost, first half, 1931	$20,770
Variable cost = $0.447 × 60,000 tons	26,820
Total production cost	$47,590

Thus we find that had we produced 60,000 tons during the first half of 1931 instead of 100,000 tons, our cost would have been $47,-

ANALYSIS OF FIXED AND VARIABLE PRODUCTION COST (HYPOTHETICAL)—SCHEDULE II

	Total cost, six months, 1932	Fixed cost	Variable cost	Variable cost per ton	Total cost, six months, 1931	Fixed cost	Variable cost	Variable cost per ton
Mining								
Labor drilling and shooting	$ 3,720	.....	$ 3,720	$0.062	$ 6,400	.....	$ 6,400	$0.064
Explosives	4,200	.....	4,200	.070	6,800	.....	6,800	.068
Labor loading	900	.....	900	.015	1,600	.....	1,600	.016
Labor hauling	660	.....	660	.011	1,200	.....	1,200	.012
Trucking cost	2,000	500	1,500	.025	3,700	700	3,000	.030
Repair labor	1,720	1,000	720	.012	2,500	1,500	1,000	.010
Repair material	2,100	1,500	600	.010	3,200	2,000	1,200	.012
Miscellaneous mine labor	1,980	900	1,080	.018	2,900	1,200	1,700	.017
Miscellaneous mine supplies	1,020	300	720	.012	1,600	300	1,300	.013
Total mining cost	$18,300	$4,200	$14,100	$0.235	$29,900	$5,700	$24,200	$0.242
Crushing and screening								
Labor	900	.....	900	.015	1,600	.....	1,600	.016
Repair labor	1,100	500	600	.010	2,200	1,000	1,200	.012
Repair material	1,600	700	900	.015	2,900	1,500	1,400	.014
Total crushing and screening cost	$ 3,600	$1,200	$ 2,400	$0.040	$ 6,700	$2,500	$ 4,200	$0.042
Storing and reclaiming								
Labor	1,920	.....	1,920	.032	3,100	.....	3,100	.031
Trucking cost	2,200	.....	2,220	.037	3,500	.....	3,500	.035
Repair labor	300	.....	300	.005	400	.....	400	.004
Repair material	420	.....	420	.007	500	.....	500	.005
Total storing and reclaiming cost	$ 4,860	.....	$ 4,860	$0.081	$ 7,500	.....	$ 7,500	$0.075
Shipping								
Labor	1,140	.....	1,140	.019	1,900	.....	1,900	.019
Repairs	120	.....	120	.002	400	.....	400	.004
Total shipping cost	$ 1,260	.....	$ 1,260	$0.021	$ 2,300	.....	$ 2,300	$0.023
Undistributed plant cost								
Power	5,400	$3,600	1,800	.030	6,700	$4,200	2,500	.025
Miscellaneous plant expense	360	360	.....	.....	390	390	.....	.....
Supervision	3,900	3,900	.....	.....	4,800	4,800	.....	.....
Miscellaneous plant labor	1,200	1,200	.....	.....	1,200	1,200	.....	.....
Rent and royalty	2,400	1,200	1,200	.020	3,200	1,200	2,000	.020
Insurance	780	780	.....	.....	780	780	.....	.....
Compensation insurance	1,080	.....	1,080	.018	2,000	.....	2,000	.020
Total undistributed plant cost	$15,120	$11,040	$ 4,080	$0.068	$19,070	$12,570	$ 6,500	$0.065
Total production cost	43,140	16,440	26,700	0.445	65,470	20,770	44,700	0.447
Tons produced	60,000				100,000			

590 as compared with a cost of $43,140 for producing the same tonnage during the first half of 1932. With costs analyzed into fixed and variable classifications comparisons such as the above are easily made, regardless of variation in volume.

Variation Due to Decreased Volume

We shall now go a step farther and determine the variation which was due to decreased volume and the variation which was due to the increase or decrease in cost. This analysis is shown in Schedule III. The actual cost for the same period of 1932 is shown in Column 2. In Column 3 we have computed what the 1931 costs would have been for the same quantity of production as was obtained during 1932. The costs shown in this column are arrived at by taking the fixed cost plus the variable cost per ton for 1931 as shown in Schedule II and applying them to the tonnage produced during 1932. It follows, therefore, that the difference between Column 1 and Column 2 is the total variation in cost which is shown in Column 6. The difference between Column 2 and Column 3 is the actual variation in cost between the two periods at the same rates of production. This variation is shown in Column 5. Therefore, the difference between Column 3 and Column 1 must necessarily be the variation due entirely to the decrease in volume which is shown in Column 4.

Referring to Schedule I again, we find that the production cost for 1932 shows a decrease of $22,330 below 1931. This is the total decrease in production cost shown in Column 6 of Schedule III. We further find in this schedule that $17,880 of this decrease was due to the decrease in volume, shown in Column 4, and that the remainder or $4450, as shown in Column 5, was due to an actual reduction in costs. A comparison of the costs shown in Columns 2 and 3 will reveal the expense accounts in which the actual variation in cost occurred.

We have now completed our analysis of the original comparative cost statement. Let us review, briefly, the steps taken. First, the cost statement for each period was broken down into fixed and variable costs in order to overcome the difficulties presented by having different volumes of production. Then, in Schedule III, we made a comparison of the costs based on the same volume of production (Columns 2 and 3) and determined the actual variation. Our next step was to determine the variation due to the decreased volume of production which is the difference between Column 1 and Column 3, with the result shown in Column 4.

These statements and schedules may appear to be complicated, but after the principles are understood they are easily applied and do not require very much time for their preparation. All companies are, or should be, vitally interested in their production costs. The only way, of course, to determine the direction in which your costs are traveling is by comparison, either with costs of a prior period or with pre-determined costs. We have found that this method of analysis enables comparisons that are not confused by variation in the production.

If a system of budgetary control is used it will be found necessary to use some method such as this if the system is to be effective. Our plan of operating under the budget system is to establish fixed and variable budget rates for each expense account. At the end of each month we compare actual costs with budget costs, determined by applying budget rates to actual production.

One's first impression may be that these budget rates cannot be pre-determined accurately enough to be of much advantage. Our experience has proved that these rates can be established with a high degree of accuracy. Of course there will be variations and these variations should be investigated, but one of the advantages of the budget system is to be able to discover and investigate variations in cost.

ANALYSIS OF VARIATION IN COST (HYPOTHETICAL)—SCHEDULE III

	(1) Cost six months, 1931	(2) Cost six months, 1932	(3) 1931 costs for 1932 volume	(4) Increase or decrease due to volume	(5) Increase or decrease due to cost	(6) Total cost variation
Mining						
Labor drilling and shooting	$ 6,400	$ 3,720	$ 3,840	—$ 2,560	—$ 120	—$ 2,680
Explosives	6,800	4,200	4,080	— 2,720	+ 120	— 2,680
Labor loading	1,600	900	960	— 640	— 60	— 700
Labor hauling	1,200	660	720	— 480	— 60	— 540
Trucking cost	3,700	2,000	2,500	— 1,200	— 500	— 1,700
Repair labor	2,500	1,720	2,100	— 400	— 380	— 780
Repair material	3,200	2,100	2,720	— 480	— 620	— 1,100
Miscellaneous mine labor	2,900	1,980	2,220	— 680	— 240	— 920
Miscellaneous mine supplies	1,600	1,020	1,080	— 520	— 60	— 580
Total mining cost	$29,900	$18,300	$20,220	—$ 9,680	—$1,920	—$11,600
Crushing and screening						
Labor	1,600	900	960	— 640	— 60	— 700
Repair labor	2,200	1,100	1,720	— 480	— 620	— 1,100
Repair material	2,900	1,600	2,340	— 560	— 740	— 1,300
Total crushing and screening cost	$ 6,700	$ 3,600	$ 5,020	—$ 1,680	—$1,420	—$ 3,100
Storing and reclaiming						
Labor	3,100	1,920	1,860	— 1,240	+ 60	— 1,180
Trucking cost	3,500	2,220	2,100	— 1,400	+ 120	— 1,280
Repair labor	400	300	240	— 160	+ 60	— 100
Repair material	500	420	300	— 200	+ 120	— 80
Total storing and reclaiming cost	$ 7,500	$ 4,860	$ 4,500	—$ 3,000	+$ 360	—$ 2,640
Shipping						
Labor	1,900	1,140	1,140	— 760	.....	— 760
Repairs	400	120	240	— 160	— 120	— 280
Total shipping cost	$ 2,300	$ 1,260	$ 1,380	—$ 920	—$ 120	—$ 1,040
Undistributed plant cost						
Power	6,700	5,400	5,700	— 1,000	— 300	— 1,300
Miscellaneous plant expense	390	360	390	.....	— 30	— 30
Supervision	4,800	3,900	4,800	.....	— 900	— 900
Miscellaneous plant labor	1,200	1,200	1,200	.....	.....	.....
Rent and royalty	3,200	2,400	2,400	— 800	.....	— 800
Insurance	780	780	780	.....	.....	.....
Compensation insurance	2,000	1,080	1,200	— 800	— 120	— 920
Total undistributed plant cost	$19,070	$15,120	$16,470	—$ 2,600	—$1,350	—$ 3,950
Total production cost	65,470	43,140	47,590	— 17,880	— 4,450	— 22,330
Cost per ton	0.655	0.719	0.793			
Tons produced	100,000	60,000	60,000			

Labor Generally Is Cooperative, Patient and Loyal

Producers See No Possibility of Wage Increases, But Wage Scales Have Been Maintained in Very Many Instances; Eight-Hour Day Has Become General

THREE QUESTIONS were recently asked producers regarding their labor situation: these were, (1) "do you see any prospect of wages increasing in the near future?; (2) is labor satisfied with its present lot?; (3) have you resorted to shorter working days or shorter week?"

What was meant, of course, was the wage scale, and the question was so interpreted by most producers. The practically unanimous verdict of some 400 representative producers is "no increase in sight." A few look for further reductions. It would appear from the character of many of the answers that wage scales have in general been pretty well maintained.

To the second question, it is evident each man's answer was tempered somewhat by his position—some answers are from presidents of our largest companies, others from superintendents of small ones. Almost all, however, show remarkable sympathy for, understanding and appreciation of the plight of the laboring man. The great majority can plainly see that labor is far from satisfied, although extraordinarily patient, acquiescent, hopeful and cooperative. Several say labor is glad of any kind of a job at any price, and a few employers appear to be taking advantage of those conditions, but in general there is every evidence of sympathy and humanity. In some very few instances dire developments are predicted if present conditions last much longer.

A California sand and gravel producer remarks, the editor believes with much truth and discernment, "the most promising indication of the continued endurance of our national traditions, and our present capitalistic system of industry, is the generally courageous and uncomplaining and hopeful attitude of labor, which has been and is on a par with that of business men in the determination to hold steady until things take an upturn."

Probably, as at no other period in history, labor has more appreciation of the problems of management and finance. Therefore, a heavy responsibility rests on employers in all industries to use their best efforts to rescue business and industry from the present depression as quickly as possible. At least employes should be able to look to their employers for some note of optimism and encouragement, rather than expressions of apathy and hopelessness that seem to be so popular these days.

Working Time

In nearly all the rock products industries, with the possible exception of the portland cement industry, work and employment are largely seasonal. Hence, any such project as that proposed by the American Federation of Labor for a universal 30-hour week of five 6-hour days is absurd. The goal to be attained in these industries is a minimum number of hours per year, rather than per day, or per week.

Another factor, clearly brought out in the questionnaire returns, is that no single producer can even approach ideal working conditions without the cooperation of his competitors in the same locality. In some localities 12-hr. working days are still in vogue, even though only two or three days a week of employment can be given. It is obvious that in these localities wage rates have been cut to the point a man must work 12 hours a day to have anything in his pay envelope.

In general, there appears to have been a sincere attempt to spread work among the greatest number possible of the old employes. In no instance, however, does there appear to have been any attempt to make work for more employes. No general method has been employed to spread the work. In most cases apparently it has been merely haphazard. By far the greater number continue the 8- or 10-hour day, and operate only when necessary to fill orders. Rotating of jobs is fairly common, one crew working one week and another the next, some two weeks at a time, some a month. A few have tried shorter working days and weeks and have given up the experiment.

Cement and Lime

Some specific experiences follow: A cement manufacturer adopted three 8-hour shifts and a 5-day week in 1931, using an extra crew to replace other shifts on their days off. It was satisfactory but the mill operated such a short period in 1932 that all the force was allowed to work 7 days of 8-hour shifts when the mill was in operation. A cement mill in the Northwest has operated regularly on a 5-day week, 6 hours per shift, using the same wage scale per hour as in 1929-30. Another mill, this one in the East, has worked 6-, 8- and 10-hour shifts, two to five days a week. One in the Central West has worked 6-hour shifts 6 days a week. An Eastern mill has used both 5-hour and 6-hour shifts. It appears that most cement plants are now on an 8-hour shift basis. Most cement manufacturers believe the shorter day, or the shorter week, or both, are permanent.

In the lime industry we find several instances of 9- and 10-hour days, although the majority have gone to 8 hours, and in a few instances to a shorter work day. One Eastern producer has spread the work by a 6-hour shift every other day for outside men and an 8-hour shift every other day for plant men. Another has a 10-hour shift in the quarry and 8-hour in the plant. An Ohio producer has put 5-hour shifts, 6-day weeks into effect, except firemen and draw men, who work 8-hour shifts 30 to 56 hours a week. Lime manufacturers are far from unanimous as to the permanency of shorter working days and weeks. One says he considers them a means of reducing wages (labor costs?), and facetiously remarks that "perfection of this plan is reached in a *no* day week." Another, who works (when he has orders to fill) 9-hour shifts 6 days a week, "can't see how shorter days or weeks can be introduced in the lime industry"; another says, "the very nature of the industry precludes such changes."

Crushed Stone

The crushed stone industry is particularly a seasonal one, and there has been a wide variety of practice in operating under conditions met with in 1932.

Of 65 crushed stone producers, six have used working shifts of less than 8 hours a day. Two in widely separated localities have used 6-hour shifts of 6 days a week; one says 0- to 8-hour shifts; one 7-hour; and two 6- to 8-hour. The largest group, 19 producers, used 8-hour shifts, with 3-, 4-, 5-, 5½- and 6-day weeks. These 19 producers were in all parts of the country from Massachusetts to Texas. Seven producers, in various sections of the country, operate 9- or 9½-hour shifts. Eleven, most of them in the South, use 10-hour shifts, one 7 days a week, when operating at all. The other 22 producers are not specific, but apparently work the same length of day, when operating, as heretofore. One Southern producer says the men prefer longer shifts with less shifts per week, to short shifts, more days a week.

Opinion as to the permanency of shorter working days and weeks in the crushed stone industry is about evenly divided. Should

production speed up, with shorter work days or weeks, more men would of course be required during periods of peak demand, unless extensive storage facilities are provided. With seasonal lay-offs, it does look difficult to justify shorter work periods, when work needs to be done. One Illinois operator objects to less than 10-hour shifts because of the time lost changing shifts.

Sand and Gravel

Of a group of 93 representative sand and gravel producers, five have worked shorter shifts per day than 8 hours; two say 5 to 8 hours; one 6-hour; one 7-hour; one 7- to 10-hour shifts.

The largest group, comprising 21 producers, from New Jersey to Washington and Oregon, operated on 8-hour shifts, 2 to 6 days a week. One producer in the East has worked half the organization one week, and the other half the next, on an 8-hour, 6-day, basis. A number of those who have operated on an 8-hour day, 5-day week basis like it and believe it permanent. Six widely separated producers operate 9-hour days, both 5- and 6-day weeks.

From Rhode Island to Texas are 19 producers who work 10-hour shifts a varying number of days per week, according to orders. Three producers from Michigan to Louisiana have 11½-hour shifts per day, but one of these expects to change to two 6-hour shifts. The remaining 39 of the 93 producers are noncommittal as to length of shifts, although most of them have tried to distribute available work by shorter weeks or by rotating employes. One states "we are using the same number of men as in 1930, but all are on part time; shift lengths vary, according to demand for products; we believe a *flexible* week is going to be permanent, giving men more hours in good time and less in bad," but at a fairly uniform rate per hour." Another says they "have tried everything; no matter what scheme is adopted, continued curtailment of production wrecks it." An Ohio operator has solved his individual problem fairly satisfactorily; he says they work full days, but not many days a week; when there is no work in the plant they all work on the company farm, where plenty of food is raised for themselves and for their stock."

The majority of sand and gravel producers believe that shorter work days and shorter working weeks are a permanent institution.

Other Industries

In the gypsum industry 8- and 9-hour shifts are the rule, with 2½- to 6-day weeks. In silica operations 8-hour shifts are most common, but one producer has operated 3-hour shifts. Several have 9-hour shifts. As in other industries, the number of days per week varies—from 1 to 6 in this case.

Two slag producers give some interesting details: one says his plants are organized for a minimum daily force, whether operating or not; when operating he tries to give an additional force a full day's work, spreading the work so as to give all the normal force some work. The other says he has tried shorter days and shorter weeks, to suit varying market conditions, but can stick to no general scheme, for he sometimes has to work temporarily a double shift to meet a shortage in one size while he has an excess in stock of other sizes.

Two Northern talc producers work 8-hour shifts; one Southern producer 10-hour shifts. A Southern phosphate producer now works 8-hour shifts, dividing work as much as possible, but may go to 6-hour shifts when the plant is working more nearly to capacity. He can accomplish the same result now by 8-hour shifts and fewer days per week. In the feldspar industry both 8- and 9-hour days are worked.

Summary

If any conclusions can be drawn from the variety of experience and practice described above, it is that the 8-hour shift is apparently definitely established in the rock products industry, in spite of its seasonal character. This is noteworthy because this industry is used to 10- and 12-hour days during normal operating seasons.

Stone Industry in 1931

PRODUCTION of stone in the United States in 1931, exclusive of stone manufactured into lime, cement and abrasive materials, or crushed into sand, amounted to 97,933,180 short tons, valued at $135,085,627, according to a compilation of reports from producers recently issued by the Bureau of Mines in an advance summary. The figures show a decrease of 23% in quantity and 25% in value from the 1930 production figures of 126,996,340 short tons, valued at $178,948,611.

All varieties of stone decreased in both quantity and value of output, as did the total output of all dominant stone products.

Discuss Development of Montana Phosphate

MONTANA'S phosphate beds are due to be developed on a large scale, according to the prediction made by G. A. Jordan of Spokane, member of the firm of industrial engineers of Vail, Jordan and Co.

Mr. Jordan has conferred with state leaders regarding developing these resources. Mr. Jordan represents the United States Phosphate Marketing Corp.

"The problem which we are attempting to solve is that of equalization of freight rates in such manner that the Montana product may be marketed as fertilizer in competition with the phosphate stone of Tennessee and Florida," Mr. Jordan said.—*Helena* (Mont.) *Independent.*

Dolomite as a Flux in Iron Cupolas

RESULTS of comparative tests of dolomite and limestone as a cupola flux are given by A. H. Dierker in the October issue of the *Engineering Experiment Station News* of Ohio State University.

The work of other investigators is noted as indicating that the use of dolomite instead of limestone as a flux gives smoother cupola operation and less change in viscosity of the slag with changes in proportions of the constituents.

Runs in a test cupola at the plant of the Perfect Circle Co., Newcastle, Ind., under as uniform conditions as possible, are stated to have given a much more fluid slag, requiring less labor, when dolomite was used than when limestone was used.

In each case the charge was analyzed and six samples of the melt were analyzed separately and averaged. These analyses showed that the pick-up of sulphur from the fuel was only half as much with dolomite as with limestone. The reason for this is not known, but it is thought that it may be due as much to the smoother operation as to the composition of the slag.

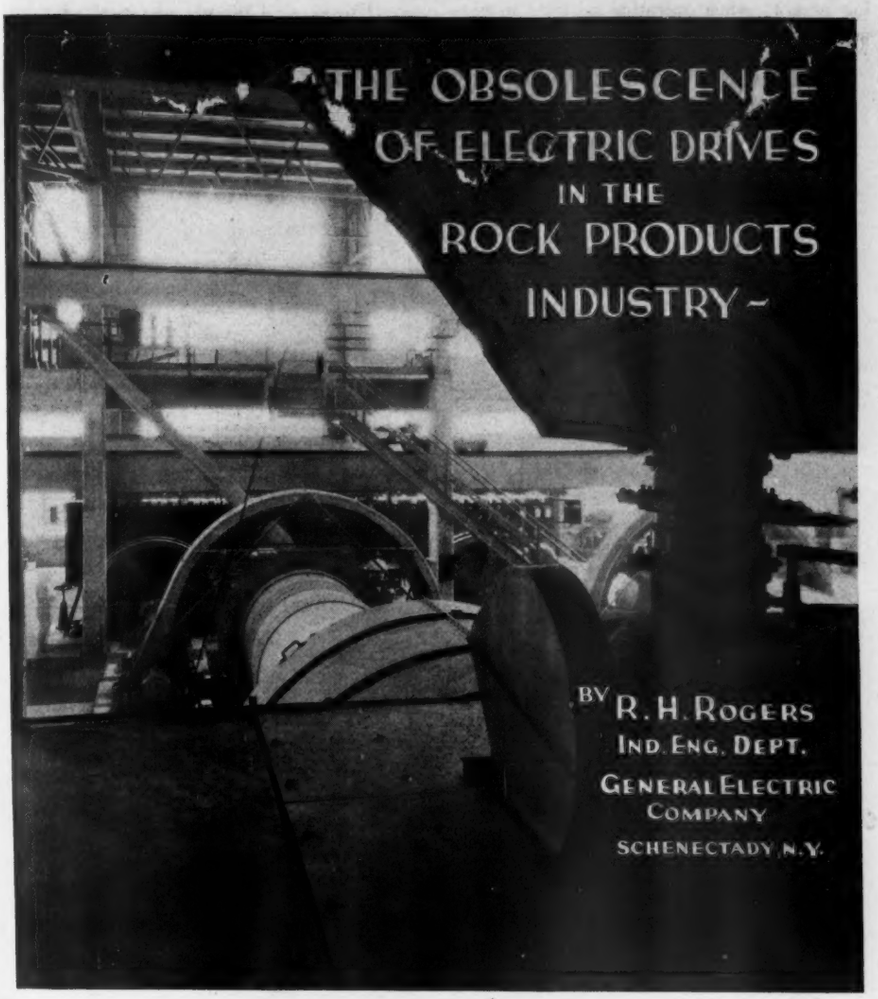
STONE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1930 AND 1931, BY KINDS

Kinds	*Short tons—1930—Value		*Short tons—1931—Value	
Granite	10,047,430	$ 30,423,853	8,068,470	$ 25,973,510
Basalt	14,532,250	17,053,031	12,552,880	13,822,835
Marble	477,240	12,905,596	350,420	10,419,834
Limestone	88,741,440	100,002,114	66,751,040	71,875,886
Sandstone	4,594,310	10,285,391	4,581,780	7,575,320
Other stone	8,603,670	8,278,626	5,628,590	5,418,242
Total	126,996,340	$178,948,611	97,933,180	$135,085,627

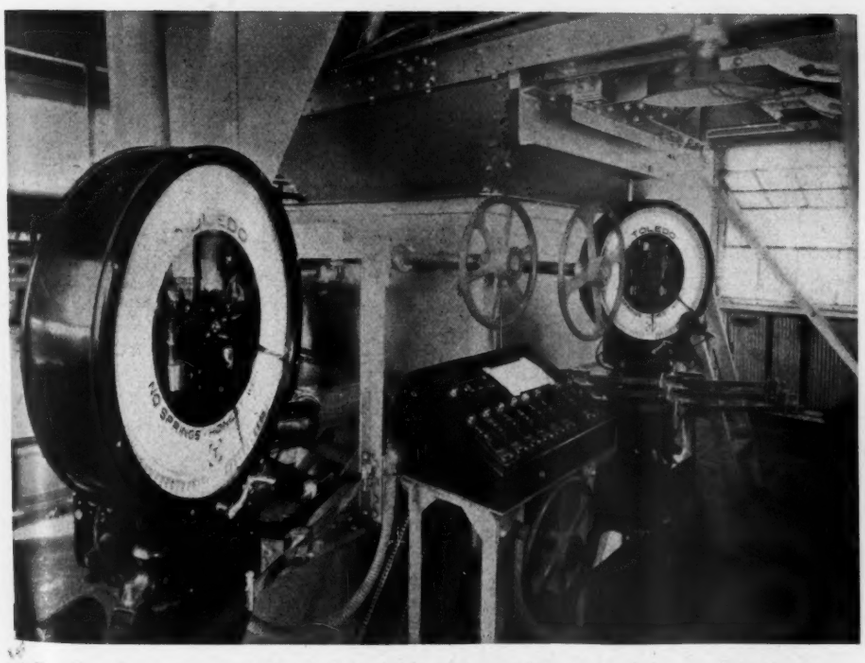
*Approximate.

STONE SOLD OR USED BY PRODUCERS IN THE UNITED STATES, 1930 AND 1931, BY USES

Use	Quantity—1930—Value		Quantity—1931—Value	
Building stone ..... cu. ft.	30,169,270	$ 39,111,527	21,461,440	$ 28,111,058
Monumental stone ..... cu. ft.	3,517,870	13,157,550	2,869,150	9,634,168
Paving blocks ..... number	31,586,626	2,669,511	22,240,590	1,938,158
Curbing ..... cu. ft.	3,358,583	3,176,102	2,135,690	2,241,586
Flagging ..... cu. ft.	1,095,780	705,775	611,920	446,525
Rubble ..... short tons	1,066,590	921,937	432,230	592,243
Riprap ..... short tons	4,292,030	4,739,122	4,222,570	4,276,626
Crushed stone ..... short tons	87,110,890	87,554,354	72,624,410	70,404,964
Furnace flux (limestone and marble) ..... short tons	17,090,710	12,362,159	9,727,230	7,193,944
Refractory stone (ganister, mica schist and dolomite) ..... short tons	1,197,500	1,406,776	611,070	633,199
Agricultural limestone ..... short tons	2,542,100	3,309,329	1,421,050	2,117,141
Manufacturing industries (limestone and marble) ..... short tons	6,021,200	5,324,274	4,501,370	3,842,158
Other uses ..... short tons	4,424,540	4,510,195	2,069,000	3,653,857
Total (quantities approximate in short tons)	126,996,340	$178,948,611	97,933,180	$135,085,627



Modern drivers in a portland cement mill



Ready-mix concrete plant with weighing, measuring and mixing under the control of vacuum tubes. While decidedly modern, the trend indicates that vacuum tubes will be as commonplace in industry as squirrel-cage motors are today

FOR MORE than 30 years, electric drive has been the accepted thing in the rock products industry. During that time vast changes have been made in every element that enters into an electric drive, so that obsolescence has grown to be a large factor in the pros and cons of existing plants.

Electric motors have not been improved upon to any startling degree and yet the aggregate changes make the motor of today quite superior to those installed ten or more years ago.

Motor control systems, equipment and devices have undergone more radical changes with the result that obsolescence has hit control harder than it has motors.

Drives, as a whole, that is, the number and arrangement of parts from power lines to the in-power shaft of a machine, have been improved for almost every type of motor application. Obsolescence has gotten in its best work on the methods of driving machines, and here the quickest returns from modernization can be realized.

Motors

Most electric motors have been improved in characteristics such as efficiency, power factor and starting torque. They have been improved mechanically, in the protection of bearings, better insulation, enclosure without reducing output, and better distribution of metal. New types have been introduced and many derivations of the older types are now available.

As a result, compromises are fewer in the choice of motors for various jobs because now there are motors entirely suited for each application that is found in this diversified industry.

Synchronous motors were long passed up as being too high-bred for the rough life in a rock products plant. The advent of the general purpose synchronous motor line opened up a wide field of application for synchronous motors that before had been the exclusive territory of induction motors. The popularity of this line is based upon sound economics. High efficiency is one characteristic, and, further, the efficiency is sustained at fractional- and over-loads, so that if such a motor is operated off its normal rating, it still operates efficiently.

The power factor situation, to which plant operators are giving much attention of late, is vastly improved by the use of synchronous motors. These motors operate at unity or leading power factor. A unity power factor motor while introducing no leading reactive kv.-a., does increase the kw. and thus improves the power factor by improving the ratio of kw. to total kv.-a. Leading power factor motors, usually 80%, have a more decided effect, since they introduce 300 leading kv.-a. for every 400 kw.

The general purpose motors carry their own direct-connected exciters so that there is no necessity for a d.-c. exciting bus. When d.-c. lines are available, however, the exciter is omitted.

The general purpose synchronous motor can take care of any job that a normal squirrel-cage induction motor can handle. Its starting torque, pull-out torque, and general sturdiness make it possible to take full advantage of its high efficiency and high power factor.

High-torque, slow-speed synchronous motors are a development of comparatively recent years. The design incorporates a double squirrel-cage winding similar to that used in high-torque, squirrel-cage induction motors. These motors will develop 140% to 175% full-load torque at start. They are built in large sizes to do the work of the constant-speed wound-rotor induction motors with better overall results.

Super-synchronous motors, well known in the cement industry for many years, have undergone improvements in many ways. This motor has a stator that can revolve and be brought up to synchronous speed with the rotor and load standing still. Upon applying a mechanical brake to the stator the rotor comes up to speed as the stator comes to rest. The whole pull-out torque of the motor is thus available for starting and the starting period can be adjusted at will to equalize the current flow throughout the load starting cycle.

Squirrel-cage induction motors have been improved as to mechanical structure and bearings. New types have been derived from the normal motor: (*a*) high starting torque, normal starting current, (*b*) normal starting torque, low starting current. The first mentioned invades the wound-rotor induction motor field, taking with it the sturdiness and simplicity of the squirrel-cage motor. The (*b*) modification is useful when high starting current inrush is objectionable, as when the motor is out on a long, well-loaded power line. Such conditions are often found in quarries or in departments far removed from the scene of main operations.

Multispeed, squirrel-cage motors have been developed in a variety of ratings involving one, two or three windings in the stator for polar groupings to give speeds in wide range and choice of ratios. Such motors are frequently of use where adjustable-speed d.-c. motors might otherwise be used. In some departments operations can be carried on with economy at reduced speeds, nights, holidays, or during periods of reduced production. For such places the multispeed squirrel-cage motor is well suited. They are less expensive to buy and to keep in service than d.-c. motors.

Wound-rotor induction motors have been affected by time as little as any type. High-speed (1800 r.p.m.) motors for direct connection are now housed in side air discharge frames to minimize windage noises and to maintain a high rate of ventilation. Multi-speed wound-rotor motors are available. Used with secondary resistance, a practically smooth speed curve can be obtained over a wide range without encountering high efficiency to the degree met with in operating normal wound-rotor motors at reduced speeds. The multispeed feature is useful on car hauls, car dumpers and similar jobs where a heavy load has to be eased to rest without shock. Dynamic braking takes place when the new low synchronous speed is established and the load is able to overhaul the motor. Final landings are made with secondary resistance followed by a mechanical brake, the duty of which is reduced practically to holding.

A radically different a.-c. motor is being introduced to the industry, although it is rather old in other industries. That is the commutator type of a.-c. motor having speed control by brush shifting and speed characteristics similar to those of a shunt-wound d.-c. motor. This motor is fundamentally an inside-out wound-rotor motor (primary-on-rotor) with a d.c. armature winding in the same slots and a commutator. Two sets of independently mounted brushes control the speed by their relative positions. A hand wheel, remote mechanical control or pilot motor control may serve to adjust the brushes for 3:1 or greater speed range, part of which is above synchronism. The efficiency of this motor at reduced speed is much better than that of a wound-rotor induction motor, the control is simple, and the speed is nearly constant at any speed setting regardless of load. Power factor is higher than that of induction motors of similar ratings. These motors are adapted for kiln drives, feeder drives, etc., where easily controlled adjustable speed is desirable.

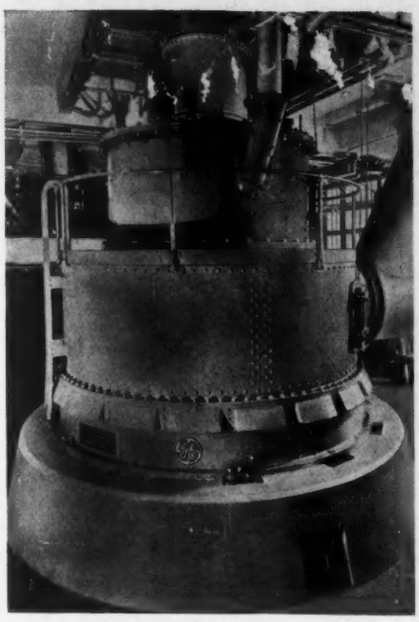
Direct-current motors have not been changed materially. Wider speed ranges have been made available without sacrificing other characteristics. An 8:1 speed range by field control can now be obtained. Heavy duty enclosed motors such as are used on power shovels have been redesigned to reduce WR^2 so that they can operate on faster cycles.

Mechanical modifications of motors have been numerous, tending to make motors more convenient to use, more resistant to agents of destruction and more adaptable to special requirements.

Vertical motors are available in almost every type and rating common to horizontal construction. They may be flange or ring mounted or tripod mounted, and bolt circle dimensions are so standardized that only three sizes are involved for frames which are identical by ratings of ¾ hp. to 150 hp. at 1800 r.p.m. Vertical pumps, agitators, feeder tables and the like can be driven by vertical motors, thus eliminating right-angle turn devices with maintenance. Usually much room can be saved by this construction, as vertical space is not as valuable as floor space.

Enclosed motors were formerly derated open motors with covers. One-half output enclosed was the common rating. Enclosed

Remote control quarry haulage system. Dispatcher in the station has full control of cars. Squirrel-cage motors and brakes are the only electrical equipment on the cars



A 72-r.p.m. power factor vertical synchronous motor built into a coal pulverizer. The pulverized coal output exceeds that of seven old-style mills driven by the belted motors

fan-cooled motors are now so constructed that full open ratings are maintained, size for size, and yet the motor parts are kept free from outside contamination. These motors cost but little more than the standard open-type motors.

A more recent development is a combined motor and gear-reducer called a gear-motor. Standard squirrel-cage wound-rotor or d.-c. motors are equipped with planetary gear speed reducers, virtually built into the end shield. The output shaft is in line with the motor shaft. Speeds at the output shaft from 600 r.p.m. to 13 r.p.m. or lower can be obtained. These gear-motors apply whenever a motor drives a lower speed machine through a belt, gear or chains or separate geared speed-reducer. They save much room in that there is no common base involved and no coupling space. They are as easily installed as a motor alone. In most cases the whole required speed reduction can be made by the gear-motor instead of resorting to a train of gears, sprockets and chains, belts and pulleys, etc.

Combined pumps and motors are available wherein the pump forms one end shield of the motor. Installation cost is reduced and much room is saved. The combination is not much longer than a motor and a coupling and the foundation has to include only the motor feet.

Control

Motor control has been subjected to a severe and fruitful overhauling in the past few years. These changes have followed certain trends. Magnetic control with push buttons has largely superseded all forms of manual control. Full voltage starting has largely superseded reduced voltage starting. In the rock products industry, particularly in cement manufacture, there is a tendency to concentrate the control of all large units at the central switchboard. Motors are better than ever protected against overloads, short circuits, undervoltage, etc. The control equipment and devices themselves are better protected, as now practically everything in the control line is enclosed. Automatic features of amazing ingenuity and great economic value are being used in connection with control.

Switchboard units are largely manufactured and wired complete before shipment. Unit structures shipped in one piece have been extended to include groups of substation panels and accessories. Such units have been shipped in one block weighing 16 tons. This procedure reduces installation costs and, often more important, saves time.

The control of synchronous motors has been advanced to a high state of development. The modern control panel for a large synchronous motor embodies new features as well as old ones in new dress. Some types of synchronous motor control and the elements used will be described.

To meet the requirements of the various applications, several complete lines of synchronous-motor controllers are available:

1. Semimagnetic reduced-voltage (auto-transformer) controllers.
2. Magnetic full-voltage controllers.
3. Magnetic reduced-voltage (auto-transformer) controllers.
4. Magnetic reduced-voltage (resistor) controllers.
5. Magnetic "part-winding" controllers.

Semimagnetic controllers provide automatic control of the connections to the synchronous-motor field, the a.-c. power connections being made by means of manually operated contactors or breakers. Magnetic controllers provide automatic control of all the connections to the motor. With this type of control, it is necessary only to close the pilot circuit by means of a push button or other device; the remainder of the starting operations are entirely automatic.

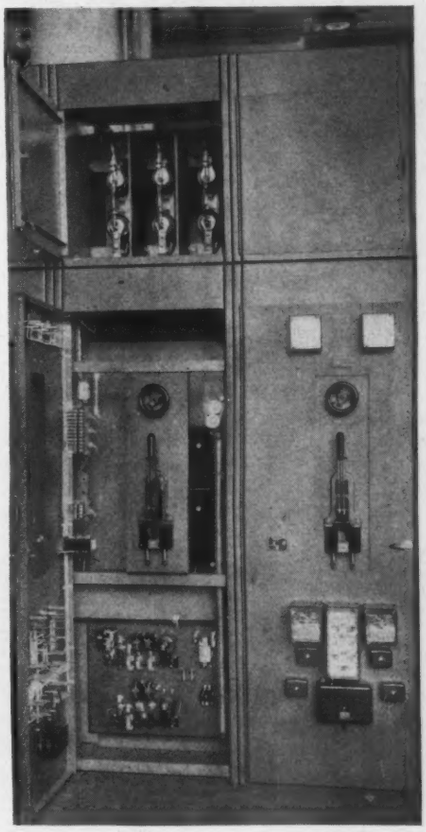
A full-voltage controller connects the motor directly to the power lines—that is, provides full voltage at the motor terminals during the starting period. A reduced voltage (auto-transformer) controller connects the motor terminals to a reduced-voltage tap of an auto-transformer at start. After the motor has accelerated to maximum speed, it is connected directly to the power lines.

The reduced-voltage (resistor) or "increment" type of controller provides reduced voltage at the motor terminals at start by inserting a resistor in series with the motor windings. This resistor is short-circuited out in successive steps until the motor is on full voltage. The circuit to the motor is not broken during the starting period; this feature is very desirable in many cases.

The "part-winding" controllers provide the effect of reduced voltage starting without the use of an auto-transformer, resistor, or similar device. This is accomplished by providing the motor with a special multiple-circuit winding. At start, one or more of these circuits, comprising only part of the complete winding, are connected to the power source. As a result, the motor starts with reduced current and torque. After the motor has accelerated to maximum speed, the remainder of the winding is energized, allowing the motor to operate in the normal manner. Like the "increment-type" controller, the "part-winding" does not open the circuit to the motor during the starting period.

The transfer relay, used on all magnetic reduced-voltage and "part-winding" controllers for automatically controlling the transfer from starting to running connections, is of the adjustable-time-delay type. This type of relay can be set to allow the motor to accelerate to maximum speed on the starting connections so that the current inrush is minimized when the motor is thrown to full voltage. The relay is operated by a Telechron motor and any time interval setting from two to 44 seconds can be obtained simply by turning a small disc.

The application of field excitation on all magnetic and semimagnetic controllers is accomplished automatically by the slip-frequency field-application relay. The coil of this relay is connected across a section of the discharge resistor with a half-wave cop-



Switchgear cubicles in centralized control switchboard for two 600-hp. synchronous motors. All wiring accessible. High tension compartments interlocked to prevent opening with power on

per-oxide rectifier in series with it. During the starting period, induced field current of slip frequency flows through the discharge resistor so that half-waves of slip-frequency current flow through the relay coil. This current causes the relay to pick up and open its normally closed contacts. When the motor reaches a speed near synchronism, the time interval between half-waves of current, which is inversely proportional to the slip, is sufficient to allow the relay to drop out and apply field. By adjusting the spring tension of the relay, its time setting can be varied so that it will apply field at any predetermined speed from 92 to 99% of synchronous speed.

It is apparent that this relay operates as a function of slip frequency, that is, slip speed. Its operation is independent of the magnitude of the inducted field current or the line voltage, i. e., it depends only on the time interval of a slip cycle, which is determined solely by the motor speed.

When a synchronous motor pulls out of step, either because of a dip in line voltage or a momentary overload, if field excitation is immediately removed, the motor may be able to accelerate and resynchronize when normal conditions are restored.

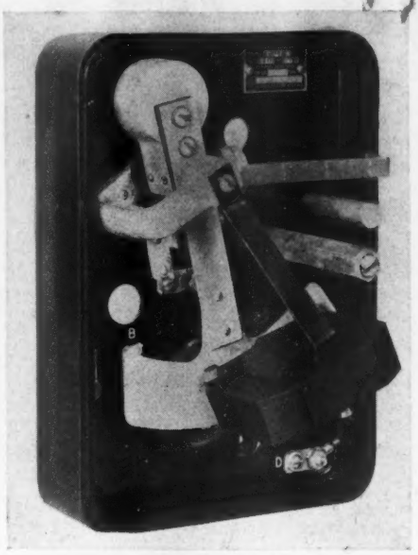
A relay for automatically removing the motor field when the motor pulls out of synchronism is known as the power-factor field-removal relay. Its operation depends on the power-factor of the current drawn by the synchronous motor.

Under normal operation a synchronous motor draws a unity- or leading-power-factor current. Even under the maximum overload which the motor can carry in synchronism, the power-factor does not drop below 70% lagging. However, if the motor pulls out of step either because of a dip in line voltage or excessive overload, while slipping poles, the motor draws a heavy current of low lagging power factor (less than 40% lagging).

The design of the power-factor field removal relay is such that it remains closed if the motor power-factor is leading, unity, or not less than 60% lagging. However, if the motor power-factor becomes less than 60% lagging, the relay operates to open its contacts, and remove field excitation. Hence, this relay will remove field only when the motor pulls out of step. Under such conditions, it operates positively to remove field immediately, that is, during the first slip cycle out of synchronism.

Stator winding protection is obtained by means of a two-element temperature overload relay. The relay heater elements are designed to follow the heating curve of the stator windings, that is, the relay will trip the motor off the line shortly before overheating occurs with any value of current through the winding.

When operating out of synchronism, a heavy current flows in the squirrel-cage winding of a synchronous motor. The magnitude of this current varies with the motor speed; in general, it is greatest at standstill. If operation out of synchronism is prolonged, the squirrel-cage winding may overheat seriously. The stator overload relay will not protect the squirrel-cage winding under such conditions, since the squirrel-cage winding of the average synchronous motor overheats much more rapidly than does the stator winding, particularly at low speeds.



Power-factor actuated field-removal relay. This element in the modern control for synchronous motors removes the field excitation in the first slip cycle as the motor pulls out of step and power factor falls to less than 60% lagging. In many cases the motor is enabled to accelerate and resynchronize after prompt removal of field excitation

To protect the squirrel-cage winding adequately under all conditions, the temperature squirrel-cage protective relay is provided. This relay consists of a single-element temperature relay, which is connected on the field-discharge circuit in parallel with a small reactor. Whenever the motor operates out of synchronism, induced field current flows through the relay heater and the reactor. The division of this current between the relay and the reactor depends upon the slip frequency and, therefore, upon the motor speed. By proportioning the reactor coil and the heating element properly, a relay is obtained which follows the heating curve of the squirrel-cage winding and which will trip the motor off the line before this winding overheats, regardless of whether the motor is stalled or operating at any subsynchronous speed.

The control for squirrel-cage motors has gone over in marked degree to magnetic full-voltage starting. Squirrel-cage motors in all standard general-purpose lines have the windings braced to stand full-voltage starting. Most rock-products plants are little discommoded by the starting current inrush and full-voltage starting simplifies the control so that it costs less and is easier to maintain.

With wound-rotor motors, master switches and contactors are used on all but the smaller sizes and the sizes at the changeover seem to get smaller every year. Contactors properly designed are long lived units compared with drum switch parts breaking the same kv.-a.

Plant power factor can be automatically governed to hold, say, at unity by utilizing a device which shades the excitation on synchronous machines to counter incipient changes in power factor. Such a device con-

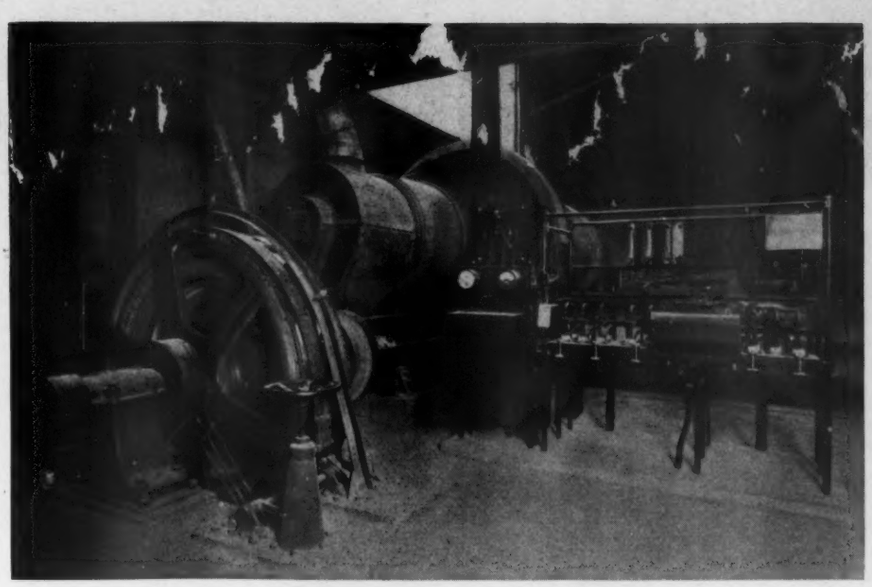
A group of thrustor-operated valves automatically controlled in sequence from a distant point. The smooth positive action of these compact motor-hydraulic units has led to their use in many widely differing applications

sists of a panel with power factor meter connected to a device which will actuate relays one way for increased lead and the other way for increased lag. These relays operate a motor-driven rheostat forward and reverse, thus increasing or decreasing the field excitation of the synchronous motors.

Induction motors operate with more lag as load is reduced than would be the case with a large low speed crusher motor between loads. Synchronous motors operate to furnish less and less leading reactive kv.-a. as the load increases as would be the case with a shovel synchronous motor-generator driven when doing the hardest work. When low induction motor loads and heavy synchronous motor loads come together the plant power factor goes down in spite of the best laid plans. To offset this condition, automatic governing is favored by plant operators.

Normally, only eternal vigilance on the part of the plant operators can curb peaks and demands which, unless held in check, can vastly influence the annual cost of power. Some of the most modern plants are equipped with automatic means for heading off these expensive erratics and at the same time releasing operators for other essential duties. In general, certain preferred loads are reflected for sequence cut-off in case of peaks or demands that threaten to go over the limit. In a cement mill all compressors are cut off in one, two, three order by solenoid unloading valves and are automatically restored in reverse order after the peak threat is over. When the demand, say, for 12 or 13 minutes, begins to threaten the 15-minute limit, one of the tube mill drives is shut down. A drive of this kind, of course, requires a restart by normal means. Automatic limiting of peaks and demands should be included for investigation along with other modernization plans.

Special automatic control features, used with nearly every type of motor and control, involve vacuum tubes, Selsyn devices or thrustors, or combinations of these devices.

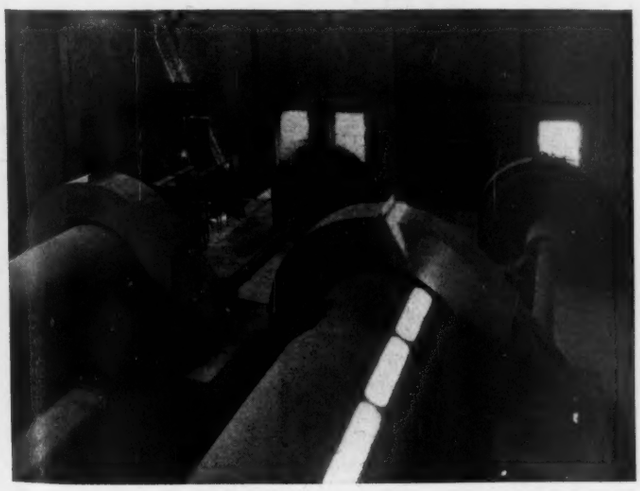


Open piece-meal assembly of control elements for a 600-hp. synchronous motor

Vacuum tubes include phototubes responsive to light or changes in light value to initiate control sequences through the assistance of amplifier and rectifier tubes and tube relays, etc. It may be of interest to note that printed cement sack tubing is cut into sack lengths on the run at 600 ft. per min. under the control of vacuum tubes. The phototube "sees" a black spot between imprints for one-thousandth of a second. If the chop comes ahead or behind that spot a train of events is started by the "eye" to correct the register. Concrete mixing is controlled automatically by phototubes which watch the weighing and measuring devices.

Selsyn devices are self-synchronizing units which are used in many ingenious ways. One may be a "transmitter" and the second a "receiver" which may indicate, control or actually do work at a distant point. Two may be transmitters, with a third acting as a differential which corrects conditions when the two transmitters indicate that their parent machines are drifting apart. Kiln feeders are synchronized with the kiln drive by such an arrangement. The transmitters are driven by the kiln and feeder motors while the differential is geared to a field rheostat in the feed motor field. Any change in the kiln speed is instantly felt by the differential Selsyn device which changes the speed of the feeder to agree with the new kiln speed.

Thrustors are straight-line pushers with strokes ordinarily 18 in. or less and with thrusts up to 6000 lb. The baby of the line has a 50-lb. thrust for 6 in. The thrustor consists of a hydraulic cylinder and a piston containing a dotor-driven impeller. When the motor is started the piston is forced to the top of the cylinder by the oil being pumped from above to below the piston. When the power is cut off, the piston drops back to the bottom quickly but without shock because of the dashpot action. These units are used for releasing brakes in place of solenoids on most a.-c. installations, for opening and closing hopper gates, remote operation of valves and similar duties where straight-line motion is required.

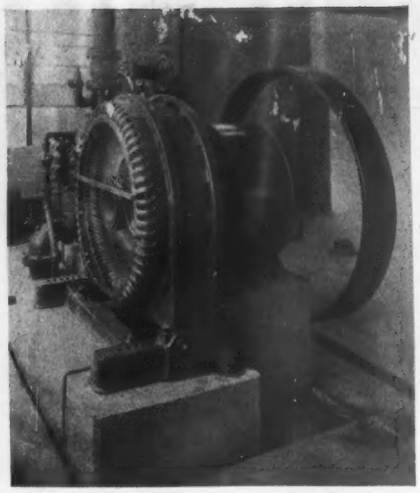


Synchronous motors, 150 r.p.m., unity power factor, driving tube mill. High starting torque is obtained by use of deep-and-shallow double squirrel-cage. These motors are started on full voltage from the central switchboard

Drives

On the one hand we have a machine or machines to be driven, on the other hand we have an electrical circuit; what we put between them today is vastly different from the practice a few years ago.

The most marked trend in recent years is to "keep the power in the wire to the last inch." While the power is in the wire it is not being wasted, it requires no lubrication, it is making no noise, it is not taking up room, and it is not as likely to injure anyone. Extensive group drives have almost no redeeming features now, and small groups, while sometimes expedient, are more often inferior to individual drive. The more equipment there is between where the electric power is converted to mechanical power and where the power is actually applied to "revenue load," the more reason there is for measuring the drive with the obsolescence yardstick. In all industries the motor is being brought closer to the point where the useful work is being done. This has necessitated the use of more and smaller motors, very high- and very low-speed motors, reversing motors, adjustable-speed motors and motors of special mechanical design. Manufacturers have so extended their electric



Overhung slow-speed synchronous motor driving compressor for air agitation. 0.80 leading power factor

motor lines that almost any drive can be selected from listed equipment.

The economy of keeping the power in the wire to a point as close as possible to where the power is required has resulted in the "multimotoring" of many machines, a step beyond individual drive. In multimotoring, each separate part of a machine has its own motor and not much else. Machine tools and wood-working machines are now equipped with from 4 to 16 motors, with the elimination of a multitude of moving parts such as shafts, cams, gears, belts, rods and universal joints, as well as all the bearings that went with them.

Individual drive and multimotoring makes it possible to select motors best suited to the work. With the wide range of characterisics now available, this means for the drive a long life free from care. The same machine may be fitted with a.-c. motors of high and low torques and speeds as well as d.-c. adjustable speed motors.

Slow speed motors have supplanted much intermediate gear. This is especially true of synchronous motors which are built down to 72 r.p.m. 60 cycles, with very high efficiency and unity or leading power factor. The presence of shafting, pulleys, countershafts, bevels and spur gears, chain and sprockets immediately indicates some degree of obsolescence. In these places, modern practice makes use of slow speed motors, gear motors, vertical motors, or individual built-in or built-on motors.

Haulage is accomplished by remote control using riderless larry cars equipped with squirrel-cage motors. The cars carry no control devices other than solenoid brakes, but a number of cars are stopped, or stopped and reversed, from a centrally located point through the third-rail system. Steam locomotives with two-man crews, night men to keep up fires, water and coal requirements would seem today to be obsolete.

The general use of compressed air for power distribution, especially through long pipe lines, is not now considered good practice. Much of the stored energy in compressed air is lost as it cools, air lines are harder to maintain than electric lines, and the air engine is low in efficiency.

Steam pumps for quarry dewatering, fed by long steam lines, pump a surprisingly small amount of water per pound of coal burned. Loss of heat on the way and the use of steam full stroke would indicate that such a system should give way to the efficient high-speed pumps and electric motors.

Group drive in the crusher plant does not allow of relative adjustments of speeds, does not apply the right kind of motor to each kind of load, and wastes power in transmission machinery. When a number of machines operate in sequence, individual electric motors permit automatic sequence starting and stopping to keep materials in the clear. Individual motors with individual control immediately correct the bad guesses made in the original scheme of things and make for smooth, continuous, efficient operation of the crusher plant.

Missing Things in Modern Rock Products Plants

When one notes the absence of the same things from every late rock products plant, he must conclude that the missing things are obsolete or that all the experience of recent years has led plant planners far astray. Here are some of the things happily missed in a dozen plants built in very recent years:

Line shafts, jack shafts, belt shifters.
Rope drives.
Tandem belt drives.
Heavy chain drives.
Magnetic clutches.
Wheelbarrow feeding.
Hand barring.
Steam pumping, steam haulage, steam shovels, steam air compressors.
Reciprocating liquid pumps.
Air drilling through long air lines.
Coal-fired boiler plant in cement plants.
Low speed induction motors.
Bevel gear drives.
Poor power factor.
Mule haulage.
Stevedore trucks.
Reciprocating steam engines.
Dust and "boiler suits" for visitors.
25 cycles.

Broadcast Talks on Highways

OVER 90 radio stations have been included in a series of educational talks on highways sponsored by the American Road Builders' Association. The last broadcast of this series was given during the current week, with most of the talks being given December 6. Among the speakers on these programs were officials of state highway commissions and departments, county and city road officials, university and college officials and faculty members, public spirited citizens and officials of various organizations interested in all places of subject.

Charles C. Cox

CHARLES C. COX, 65, president of the Cox Lime and Stone Co., Plymouth Meeting, Penn., and member of the old Common Council, died December 9 after an illness of several weeks.

Road Officials Ask New Federal Appropriation

SO THAT the states may go on with their road construction and job-giving programs, immediate action by Congress in continuing the regular federal aid road appropriations was urged in resolutions adopted at the recent convention of the American Association of State Highway Officials.

The association points out that authorizations for federal aid terminate with the fiscal year ending June 30, 1933. New appropriations must be made for 1934 and 1935.

Because of the large road task and the great numbers of workmen dependent on highway building, Congress should again make $125,000,000 available for roads for each of the fiscal years 1934 and 1935, declares the association.

It is further asserted that even with annual appropriations of $125,000,000 the states will have less federal money for roads than in 1932, because emergency federal road advances and loans from the Reconstruction Finance Corporation must be repaid to the federal government from future federal aid allotments. This can amount to $41,000,000 per year.

Facts cited to the association by W. C. Markham, executive secretary, in his annual report show the need for continuance of federal aid on a large scale, not only because of road needs, but also because of employment.

Mr. Markham states: "Only 40% of the roads on all the state highway systems had a dustless surface or better January 1, 1932.

"Only 99,538 miles of pavement were on all the state highway systems January 1, 1932, out of a total mileage of 347,867.

"Roughly speaking," continued Mr. Markham, "14% of all roads are on the state highway systems, whereas five years ago state highway systems were comprised of 10% of the total mileage. This growth in mileage has resulted in increased costs to the states.

"In August, 1932, an average road building month, 333,000 men were employed in state highway work directly on the job, including federal aid projects. This means that one out of every 367 persons in the United States was earning his livelihood through state road construction by direct work, while there were at least two men preparing and transporting material to the jobs, making in all at least 1,000,000 men given employment for state road work only. If for no other reason than the provision of jobs, federal aid should be continued on its present basis," concluded Mr. Markham.

Trends in Machinery, Equipment and Supplies

EFFICIENCY, in most cases meaning economy, has been the goal—though improved quality of product has also been provided for. Closer control, with increased use of instruments, is a constantly increasing factor.

Efficiency has been increased to a large degree by the use of anti-friction bearings. The early tendency was to use this type of bearing only in those locations subject to the most severe service.

Economy is attained by reduction in maintenance and repair. Parts have been strengthened to reduce breakage, and wearing parts are being made of better materials. In some cases weight has been reduced, with greater strength. The amazing progress in the development of special alloys has been an important factor. The use of manganese steel in locations subject to abrasion has been greatly extended.

Measures to reduce or eliminate vibration have been taken, not only in vibrating screens but in most types of equipment subject to vibration. Stronger parts and better application of the metal in these parts have been obtained with increasing frequency by the use of welding. Reduction in number of parts has also been achieved by many manufacturers. Greater accessibility to facilitate replacement and repairs has received much consideration.

New principles have been developed and introduced, even in such old processes as crushing. Some of these have been promptly accepted by the industry. Others have not shown sufficient improvement to warrant scrapping of equipment already in use.

This review is not intended to point out specific changes in every piece of equipment that has been manufactured in recent years. Rather is it intended to point out the general trend.

Explosives

RECENT IMPROVEMENTS in explosives have been directed at reducing the cost per pound of material freed, to reduce smoke and fumes produced, to increase safety in handling without reducing sensitiveness, and to improve fragmentation.

Improvements made in blasting machines make them moisture- and dust-proof. Capacities have been increased. Cordeau connectors have been improved, equipment for circuit testing to prevent misfires has been introduced, and a shunt for enamel-wired blasting caps, all add to the efficiency and safety of quarrying.

Drilling

IMPROVEMENTS IN DRILLING EQUIPMENT facilitate more economical location, size and drilling of holes. Tower mountings, some of all steel construction, have been made adaptable to wagon, crawler or truck mounting of well drills.

To reduce vibration in an all-steel drill one manufacturer has introduced a rubber cushioned shock absorber in the derrick head and insulates the spudding sheave on the beam with rubber.

The greatest innovation in drills was the introduction of a drill for horizontal blast holes, which also drills at any angle. This was designed to work from the bottom of the pit or from a bench. Light weight drifting drills have gained considerable popularity. Feeds have been improved to permit 8 to 12 ft. of drilling with the same steel.

Auxiliary equipment includes improved drill steel, safety clamps for diamond drills, a new bit for diamond core drills in which bits are furnished "set" for the convenience of smaller operators who find it uneconomical to employ a diamond setter, pneumatic feed for rock drills and detachable bits and drill rods. An anti-freeze air line system to reduce air line freezing and freezing at drills has met with favor in many quarries.

Drill-sharpening equipment has been markedly improved. One sharpener will forge bits on blank steels in two or three heats, or redress dull bits in one heat. Capacities have been increased, both in variety of bits handled and simplification of operations. Accuracy and quality of finished work has been increased. High pressure oil forges for heating drill steels have been introduced. An electric automatic heat treating furnace is also now available.

Hoists and Cranes

IMPROVEMENTS of hoists come under three headings: (1) anti-friction bearings; (2) improved braking and (3) simplification of control. Larger braking area, with the addition of asbestos linings, has been the general trend. A solenoid brake has been used, however, with most satisfactory results.

Air control has been installed on units as small as 100-hp. The number of controls has been reduced. For car-pulling remote control has been popular. Life of sheaves has been increased. All moving parts, except sheaves, are being enclosed.

Excavating Equipment

THE 1- to 5-yd. convertible shovels continue to lead in popularity and demand in the rock products industry. For portable plants, as auxiliary units of commercial plants, smaller shovels, ⅜- and ½-yd., are used. In some large plants these small shovels are also enabling operators to reduce excavating costs for miscellaneous work.

Improvements summarized are greater speed, strength and durability. The steam-powered unit is a matter of history; electric power is favored wherever available. Diesel power is preferred by some operators to gas, where electricity is not used, though far more gas powered shovels are sold than Diesel as yet. Oil filters, electric starters, air cleaners and in one case Maxim silencers are among features included. Six-cylinder engines have made their appearance.

Control has been greatly improved, air being used quite generally with internal combustion power plants. Electric-powered plants usually provide electric control as well, one make of shovel entirely eliminating brakes and clutches. This is obtained through a multi-voltage direct current field control, with separately excited shunt-wound motors.

Much improvement has been made in clutches, where they are used, and a shoe-type thrustor oil brake for alternating current motors is an important improvement in brakes. Steering from the cab with rotating frame in any position is demanded in new excavators. Chocking brakes to hold machines up to the work are now quite general, some providing for move-ups without release of brakes. Chain and rope crowd now permit adjustment without disconnecting. Gears having helical cut teeth have been introduced.

For draglines aluminum booms are being manufactured. Buckets, both for draglines and other excavating purposes, have been increased in strength and durability per pound of weight. Here, too, aluminum alloys have been used in some cases. Welding is being used, particularly where it will eliminate rivet heads that interfere with efficient operation. Lips have been hardened. They are also renewable in some cases. Renewable, reversible, teeth are standard with a number of buckets. Methods to regulate the digging and dumping angle of buckets for draglines have been added.

A radical departure from established design in a dragline scraper bucket claims to load faster, but not to overload; to require less power; pull true and smooth; leave floor of the pit level; empty quickly; and take all wear on the cutting blades. A bucket was also introduced for use behind a tractor, and it is controlled entirely by the tractor operator.

To reduce stripping costs wherever heavy stripping is required and the stripping can be returned to a used part of the quarry, a stacker has been developed. This is said to have greatly decreased stripping costs where conditions are favorable for its use.

For drag scraper work a device has been perfected to permit operation along two paths at approximately right angles. Design of head towers has been improved.

Bulldozers and roll-over scrapers have found application at some operations and have made possible more economical handling of materials on the way to the plant.

Transportation Equipment

THE MOST noteworthy development, in so far as the large quarry is concerned, is a remote controlled alternating-current electric haulage system.

One large quarry substituted 15-ton trucks with 10-cu. yd. bodies for rail and cars. Trucks dump to skip hoists, which elevate from the quarry to the crusher house. Self-propelled one-man operated cars equipped with either 1- or 3-way hydraulically dumped bodies with dump controlled from the cab make possible more economical hauling under some conditions where rail haulage is best adapted.

Many models of industrial locomotives have been introduced. One objective has been to improve operation on rough tracks. Another has been to increase draw-bar pull. Considerable success has been achieved toward these goals.

From a mechanical standpoint an outstanding development in recent years in smaller locomotives is a series in which all driving connections between the motor and the wheels are accomplished by gears and clutches to both axles, making all four wheels driving wheels.

Quarry Cars

AS NOW CONSTRUCTED, quarry cars give far longer life with less repair and maintenance than was ever expected a few years ago.

Improvements in dumping include automatic devices, and unloading has been facilitated. One car dumper of a reciprocating type serves also as a reciprocating feeder for crushers. In track accessories, the mechanical track shifter is the most important.

Motor Trucks

SOME MANUFACTURERS are making it possible to get truck bodies with many of the construction features of quarry cars.

Three-way power dumping has proved a very desirable feature, particularly for delivery of materials from the plant. Trailers of novel design have also been developed with the prime objective to reduce delivery or handling costs. Aluminum is being used to some extent to reduce dead-load.

For those producers who contract placing of materials on roads, special gravel spreading equipment is available to be used in conjunction with dump trucks. An even layer of a controlled thickness may thus be placed on the roads.

Tractors and Trailers

TRACTORS and trailers have largely displaced trucks for earth moving in highway construction on short hauls and deserve the study of rock products operators. They operate in rougher going and will stand much rougher handling than commercial trucks.

Crawlers have been improved to require less maintenance and to eliminate operating delays, and power plants of tractors have greater power output and provide better handling. With the development of various pieces of equipment, such as power scoops, air compressors, cranes, hoists, etc., for tractor mounting this piece of equipment has become a factor of increasing importance about the rock products plant.

Other Methods of Primary Transportation

AERIAL TRAMWAYS merit consideration. Such tramways have been installed in a number of important operations in recent years, though they are still in much less use in this country than in Europe. Tautline cableways are also adaptable to such transportation for distances of less than 2000 ft. Other possibilities are suggested in articles appearing in ROCK PRODUCTS during 1932, among which were: "Field Conveyors from Pit to Preparation Plant Save Money," and "From Shovel to Dredge Excavation After Year's Operation."

Conveyors

PERHAPS outstanding in the change in conveying practice has been the adoption of transportation of finely ground material, such as bulk cement, by air. Systems for this purpose have been installed in many cement plants and in ready-mixed concrete plants where they are equipped for handling bulk cement. These pneumatic systems have the advantage of being readily installed in existing plants without requiring extensive alterations.

A mechanical conveying system which also has this advantage to some extent is moved by lugs or conveying arms attached to a cable or other flexible medium. Flow in this type of conveyor is compared to water through a pipe. It operates in all directions and angles.

Improvements in belt conveying systems have to do largely with carriers in which the length of life has been increased, power requirements decreased, and lubrication systems improved. Improvements have been made in conveyor belts as well, which notably extend their life and service. Buckets for bucket conveyors have been strengthened by use of alloys. A special "wing" type tail pulley to automatically eliminate materials that get between it and the belt has lengthened the life of belts.

An interesting development in handling cement clinker and similar hot abrasive materials over long distances is a vibrating tubular conveyor. A rotary tubular conveyor with screw flight cast integral with the casing and having no internal bearings also serves this need. By introducing cool air this conveyor may also serve as a cooler. It will convey materials up a considerable slope. Both of these are adaptable to the handling of hot flue dust.

The newer pan conveyors and feeders give longer life; have been stiffened, and continuous overlapping has eliminated leakage between pans; are now available with direct motor drives, also with variable speed mechanism.

A development in heavy duty pan feeders, where accurate control of tonnage fed to rolls is required, employs a vibrated deck. Positive, electrical control over the tonnage fed to the rolls is maintained.

An interesting device not strictly a conveyor has been devised to prevent segregation of aggregates when loading from bins. Another interesting development is an agitator developed for crushing frozen lumps of aggregates and crusts that tend to arch over and clog discharge gates and overhead bins.

Motors and Electrical Equipment

MANY improvements have been made in electric motors. These improvements are covered in detail in the article, "Obsolescence of Electric Drives in the Rock Products Industry," elsewhere in this issue. Much advance has also been made in electrical control of machinery and equipment outside of its power requirements. Descriptions of these are included with the equipment for which it is designed.

Power Transmission

THE chief development in power transmission has been the increased use of speed reducers, which are now used quite generally throughout the rock products industry, and a combination of motor and speed reducer as one unit supported by the same frame. There have been many sizes and types of speed reducers introduced, so that practically any speed ratio in most horsepowers can be obtained.

Adjustable arm motor bases have been introduced for short center leather belt drives which, it is claimed, tune the motor to the work and measure the load, providing more efficient operation. For short centers the use of V-belt drives has grown rapidly as well. Improvements have also been made in friction bearings. Central lubricating systems that control the quantity of lubricant for each bearing requirement have been installed in a number of plants.

An interesting development is the announcement of equipment which is practical for smaller plants that will vulcanize endless belts.

Pumps

EFFICIENT OPERATION of dredge pumps is difficult to check. It is probable that many dredge pumps now in operation are inefficient and expensive. Efficiency

decreases rapidly with wear, and various reports indicate that many pumps have been permitted to operate long after they passed a point of economical operation.

Improvements made in dredging pumps include: (1) mechanical construction and operation; (2) wearing qualities of the metals used in parts; (3) lower cost of repair parts and labor required; and (4) mechanical efficiency.

To improve mechanical construction and operation heavy anti-friction bearings enclosed in dirt- and dust-proof housing with extra heavy shafts have been adopted; heavy rigid sub-base to assure constant alignment; one manufacturer combines the main and thrust bearing. Direct connected pumps with gas, Diesel and motor power are used in greater number.

To improve wearing qualities manganese steel and alloys of various types are used.

To keep repair costs, including labor, low special liners that can be quickly and easily replaced are used to protect the outer shell or casing. Split frames are increasing in number.

To improve mechanical efficiency (which has amounted to 50% in some cases) closer clearances between moving parts have been provided. Design of volute and impeller vanes has been given added study. Pump impellers are being hydraulically balanced and internal leakage at the suction intake has been greatly reduced. One series of pumps has an adjustable main bearing that the clearance between impeller and entrance side of the pump may be kept constant. Improvements have increased efficiency to as high as 80 to 90%.

To increase flexibility of units a balanced suction series pump which makes it possible to connect two or more independent single-stage pumps in series to handle heads higher than those practical for single-stage centrifugal pumps are now available. A similar result is obtained with a pump which provides for two or more series of impellers. Pumps are being manufactured as small as a 1-in. intake for gritty materials and slime.

Pumps of all types are being placed on portable mountings. Self-priming pumps are increasing in number.

Accessories have been improved, outstanding of which is the development of spiral welded pipe.

Liners of elastic rubber to increase the life of chutes, hoppers, dredge sleeves and other equipment where abrasive action is excessive are also available.

Dredge pipe couplings of longer life and greater flexibility have been developed and considerable improvement has been made in valves for dredge operations.

Dredges

ONE of the most novel of installations is of a sectional steel dredge with ladder. This dredge was built in eight sections at the factory and assembled at its point of operation. The use of steel dredges is increasing. In addition to improvements in pumps, there has been much progress in the design of screen nozzle ladders and cutting heads.

A meter to determine and indicate percentage of solid materials in the flowing fluid has been developed. A clamshell bucket dredge for reclaiming sand in water 100 ft. deep has been built.

Crushers and Pulverizers

CHANGING requirements resulting from stricter specifications for aggregate and improved methods of road construction require constant vigilance of operators to keep their plants equipped to meet demand economically.

Because many operators have not given this matter the study it merits probably accounts for a statement, by one who has studied crushing problems for many years, as follows: "I think I could go into any crushing plant in the United States and suggest changes that would increase efficiency, and therefore profits. I would not necessarily do so by putting in new types of units. In a majority of cases I might merely change the units in use to some other type of unit which might be equally as old. And when I made that change the chances are that the discarded unit might in turn displace something in another plant to make it more efficient."

Which simply means that there are many factors influencing the selection of the most economical crushing equipment for each job —that these factors change as demand or character of the deposit change—and that much waste is now taking place that could add profit if corrected.

Improvements made in crushing equipment, with a few exceptions, have not been of a radical character. Efficiency of existing types has been increased to take larger feed and to produce a larger percentage of fines, or material under ½-in. mesh.

Probably the greatest advance has been made in pulverizing equipment for materials which must also be dried. Such equipment is described under cement mill equipment, but has application in many other branches of the rock products industry.

One notable improvement of gyratory crushers is the use of curved heads and concaves, often referred to as non-choking, instead of the straight type, to secure a smaller discharge opening and a large feed opening. Choking is said to have been thus minimized and the capacity for a fine product increased. These can be installed in any gyratory crusher.

A development in cone crushers increases the output of fine products without decreasing output of the crusher, it is said. The most important change in design has been in the shape of the crushing cavity and the design of head and bowl.

One development in hammer mills has been in grate bars, curved concentric with the axis of the crusher shaft, spaced to permit the hammer to swing between them, extending area of work to the feed hopper. An interesting development of auxiliary equipment is a renewal tip for hammers.

One new type crusher uses an oscillating cylinder acting against curved concaves.

A ring-roll mill is claimed to grind either hard or soft substances with equal efficiency. A roll crusher is being made with an inserted tooth roll. Roller bearings have helped to eliminate troubles with dust in babbitted bearings in roll crushers. A new driving arrangement for double-roll crushers permits adjustment of roll settings.

Screens

DEVELOPMENT in vibrating screens has been to eliminate transmission of vibration to the structure, to increase effective screening area, to reduce power requirements, to facilitate flexibility of production and to strengthen and improve construction to extend useful life.

What has been accomplished in lengthening the life of screens themselves applies both to vibrating and rotary screens. These improvements have largely resulted from the use of alloys.

For coarse angular materials a roller bar screen is claimed to be immune from blocking, jamming and jarring and to be free of any crushing action. It has been utilized satisfactorily for washing operations as well.

In addition to regular plant installations for sizing purposes vibrating screens are also finding a use at the point of loading, where a final screening is now being made, which adds materially to the quality of the product sold.

Another interesting development is the combination of a small vibrating screen with portable loaders for loading from stock piles. Screen cleaning devices are available with many models.

A vibrating screen accessory is a meter which indicates angle of screen operation.

Washers and Scrubbers

ROTARY cylindrical or conical screens or containers still lead as the popular washing device for gravel and crushed stone. Improvements include the introduction of balls, chains or similar device to increase the scrubbing action.

Screw or log type washers are extensively used and improvements consist largely in bearings and feed and discharge features to decrease power and increase efficiency.

Magnetic Separation

THE most outstanding development in this type of equipment is its extension to materials not generally considered magnetic. This improvement has given higher capacity at the same time. It is now possible to separate gypsum from dolomite and mica from feldspar, it is claimed.

Classifiers

THE need for classifiers has increased and they are no longer a novelty to the rock products industry. Installations in sand and gravel plants quite generally depend on hydraulic means for the classification. Equipment for classification in closed-circuit grinding, now quite generally employed in the manufacture of cement, most frequently depends on air for classification. Many types of classifiers have been developed and are giving satisfactory service.

Cement Mill Equipment

RECENT years have seen a number of important changes in the manufacture of portland cement. Most important of these has been in grinding, though economies have also resulted from kiln improvements, better clinker cooling equipment, and other general developments such as lower conveying costs, improved feeders, etc.

The most generally adopted development in grinding equipment has been closed circuit grinding in compartment mills. Decided improvement has been made in these mills since first introduced, so that some of the early installations that have not later been improved find it difficult to equal cost and quality of later mills.

Other types of mills have also been introduced which operate on entirely different principles. Most recently announced of these is one now being used for crushing ore, in which field the compartment mill originated. This new mill uses the material itself as the grinding medium. This is accomplished by a bucket wheel dropping the material to striking plates, where crushing results. The lower part of the bucket wheel rotates in a tank which acts as a classifier.

A series of pulverizers employing the ball bearing principle of grinding is designed for particular service in cement plants. One unit is for closed circuit operation on raw material, one for closed circuit operation on cement clinker, and one, with integral feeder and blower, for direct firing of cement kilns.

A conical ball mill with internal air classification has been used in some cement plants. The mills are also available to dry as they grind, a feature which makes this mill of increased value in applications such as grinding of gypsum, phosphate rock, talc and other uses outside the cement industry.

A planetary mill for closed-circuit grinding with mechanical air separator has been introduced which is particularly adapted to pulverizing limestone, gypsum and similar nonmetallic minerals preparatory to classification. It is claimed to grind to a medium degree of fineness with high capacity at low cost.

Other important developments in grinding mills which dry as they grind include a roller mill equipped with air separation and air drying which also feeds and conveys the product to storage, and an impact type mill with automatic feeding device, air separation system, a concentrator collector for cleaning the venting air, a main exhauster, a vent fan, and welded-seam steel piping.

Improvements have also been made in pulverizers for power plants, and some of these pulverizers are being utilized for other uses about rock products plants. One example of this is a table roller pulverizer being used to pulverize gypsum rock.

Kilns

In construction of the rotary kiln proper the outstanding improvement has been the adoption of the enlarged calcining zone, which has increased kiln capacity, decreased fuel consumption, and gives a more uniform and better clinker.

Interesting developments are kilns with slurry driers built integral and others having coolers with a special chain system in the drying zone which, it is claimed, has given fuel economy of wet process plants equal to or better than for dry process plants.

Important strides have been made in auxiliary equipment, also. Various types of driers, coolers, slurry filters, centralized kiln control, feeders, mixing and blending systems, and conveyors all have been developed to have a favorable influence on the cost per barrel of output. Dust collection and recovery systems also have increased in economic importance.

The rapidly increasing use of bulk cement has demanded changes in loading and handling methods, and equipment to facilitate making this change economically is available. Special railroad cars and truck bodies have been designed to reduce cost of transporting bulk materials. Pneumatic systems have been improved, and are playing an important part in improving cement quality in dry cement plants by making possible better blending. An improvement of note in this type of equipment is that they will now pick up their load, as well as to convey it.

Clinker Coolers

Rapid chilling that is obtained with the better type coolers is said to reduce to a great extent the cost of grinding. The rotary cooler is the most general type in use. The kiln with coolers built integral has shown economies in a number of installations.

Most recent is a conveying grate type of cooler in which the clinker is taken directly from the kiln and transported by vibrating grates. Cold air is injected through the bed of hot clinker. An intimate contact is thus obtained between the air and the clinker and high efficiency results, which is claimed to make the clinker as much as 25% more grindable than when rotary type coolers are used.

Another cooling device claims for its special feature that it utilizes the heated air from the cooler in preheating the air for combustion more effectively. This is accomplished without the use of a separate cooler or other external apparatus. Cooling is accomplished in the end zone of the kiln proper The principle can be used with rotary coolers, allowing them to complete the cooling.

Feeders

Constant, controlled feeding of kilns and grinding equipment has been proved to increase capacity where this is practiced. Obtaining as near 100% output of all equipment as possible is recognized as a requisite for economical operation. To make this possible feeders to handle material of sizes from fine to coarse have been developed. Most of these feeders employ weighing devices, all of which are operated automatically. These devices are manufactured in form to fit under hopper bins to feed directly from them, and to require a minimum of space. Photo-electric tubes are finding application in a number of these feeders, while others operate entirely on mechanical principles.

Refractories

BOTH in cement and lime kilns there has been an increasing use made of high alumina brick for refractories. This type of refractory has shown ability to last through a greater number of shutdowns as well as having longer life. At the same time improvements have been made in fire clay refractories to extend their life, and some operators feel greatest economy is obtained by the use of high alumina brick in the burning zone of rotary kilns and of fire clay in the remainder of the kiln. Silica brick have also been improved and excellent results have been reported with these improved brick in lime kiln operation.

Magnesite brick have been used at various times for cement kilns, but little satisfaction had been reported until the past year. A recent application of these indicated that this refractory may yet develop into one of importance to the cement industry. A detailed report of this installation was given in the article, "A New Cement Kiln Refractory," in the November 5 issue of Rock Products.

There has been a tendency among operators to make small patches in the lining of kilns rather than replace all of a section of lining which is not in the best condition. Since each shutdown greatly reduces the life of the kiln lining, the actual cost of temporary repairs is far greater than the difference in the cost of the section needing immediate replacement, where it may result in another shutdown to permit a later repair. And no matter how good the refractory used, if it is unnecessarily abused by frequent shutdowns caused by patching rather than replacement, the cost of this item will be excessive.

Compressors

ONE IMPORTANT development in compressors is the direct-connected Diesel engine drive. The compressor load is well adapted to Diesel power and the decrease in

weight of Diesel units has reduced space requirements.

Air compressor controls for automatic or semi-automatic control have been improved. Some manufacturers have increased the number of cylinders in their compressors, and vertical units are available in increasing numbers.

Dust Eliminators

MUCH improvement has been made in the equipment for dust control, chiefly to collect a higher percentage of the dust and to reduce space requirements for the equipment. Maintained efficiency has been one of the important problems and progress has been made in solving this.

While the initial motive was to promote cleanliness about the plant, with a resulting increase in efficiency and health of employes, the recovered dust has been found valuable, and that material recovered is claimed to have returned the cost of the equipment in numerous instances. Regardless of this fact, the increasing number of claims of industrial disease and a recent ruling that plants which have taken suitable means to protect their employes from the hazards to which they are exposed are not responsible for disease which is contracted, the installation of protective equipment would seem both desirable and advisable.

Prime Movers

IT IS quite generally agreed that the use of steam is not in keeping with present demands of most rock products plants. Where electrical power is economically available it is preferred by many operators.

Improvements in internal combustion engines have made them highly competitive and particularly has the Diesel engine grown in importance. The economy of Diesel engines has won for them merited respect and their use has not been limited to isolated plants.

Alloys

INCREASED volume in the rock products industry has accentuated the need for abrasive resisting materials. Shafts and other parts of equipment which are not subject to abrasive action but in which higher strength is essential to increase useful life or decrease possibility of expensive repair also has resulted in extensive application of alloy metals.

Weighing Devices

WEIGHING EQUIPMENT has increased tremendously in importance to the rock products industry. Improved quality of cement demands more accurate chemical control of cement, making accurate weighing equipment an essential factor in obtaining satisfactory results. These varying demands have called for special equipment to handle particular materials in a variety of conditions.

Efficiency and economy in operation of weighing devices has been augmented by the application of electrically controlled devices, particularly those employing photo-electric cells.

Ready Mixed Concrete Equipment

IMPROVEMENTS made in ready-mixed concrete equipment include not only mixers, but batching hoppers and auxiliary equipment. The improvement in batching hoppers is almost entirely the result of improvements in weighing devices which have been increased in accuracy and have been made better adaptable to batching bin needs.

Improvements to truck mixers are generally directed to facilitate loading and discharge, to give more accurate water control, to provide the most thorough mix and prevent segregation, to lower the center of gravity, to increase the life of the equipment, and to extend the area of discharge direct from the truck.

To improve quality of ready-mixed concrete, increased accuracy of control of water content is essential, and most improvements which have been announced in this type of equipment have included this feature.

The use of ready-mixed concrete in pavement construction has greatly extended the market for this material. Side discharge truck mixers have facilitated the placing of concrete for such work.

To extend the area of discharge from the truck, hoists have been added which elevate the mixer drums to add approximately 80% to the spouting area. This is a service of considerable value to the contractor or user of ready-mixed concrete and might be classed as a merchandising feature.

Aluminum alloy castings are used in such equipment to reduce weight. Controls have been improved to enable the driver to load and unload with the least inconvenience.

Plants for handling bulk cements economically on the job and having a certain degree of portability have been developed. Both screw conveyors and air are used in transporting cement in different units of this type. A pump for handling mixed concrete was introduced during the past year for which some ready-mixed plants may find use.

Cement Products Machinery

A NUMBER of improvements have been made in cement products machinery. These include automatic pallet feeds for strippers, and an increase in the number of products that can be made on any one stripper.

A machine for the manufacture of roofing tile has been perfected which is claimed to make them cheap enough that they can be sold to compete with wood and composition roofing in price.

Vibrating equipment is being used in the manufacture of an increasing number of products, and with the great interest that has taken place in this subject that use should increase. This will probably have an important effect on manufacture of concrete floor beams and non-loadbearing partition units.

A machine for automatic production of concrete burial vaults has also been perfected and installations have been made. These machines are claimed to reduce the cost of manufacture and to improve the quality of the vaults.

Wire Rope

SOME PLANTS find rope costs high, which is frequently caused by worn sheaves and poor drums, the replacement of which would be far more economical than the more frequent replacement of rope necessitated by excessive wear which they cause. There are many kinds of wire rope manufactured, and economies may be made by checking up to see if the proper kind is being used for the service demands.

Cement Slurry Filtration

IN SPITE of the situation in the cement industry, considerable progress has been made with cement slurry filtration, one large installation in the United States and four foreign ones having been made by Oliver United Filters, Inc., New York, N. Y., during 1932.

The Oklahoma Portland Cement Co. at Ada, Okla., is allied with the Arkansas Portland Cement Co., where filters have been in operation for several years, and first-hand knowledge of operations at Arkansas indicated it was well worth while to install them at Ada in spite of difficult conditions in the industry.

Consequently, during the summer of 1932 two large American filters were installed over each of the three kilns at Ada, making the total filter area the largest in the industry. The plant output with filters is well over 6000 bbl. per day, which is larger than that of any plant previously equipped.

The filters reduce the kiln feed moisture from 40% to 21%, and in so doing provided a fuel reduction during the first three months of operation of approximately 500 cu. ft. of 1000 B.t.u. gas per barrel of cement. When the operators become more familiar with the new burning conditions this reduction should be increased at least another 100 B.t.u. per barrel.

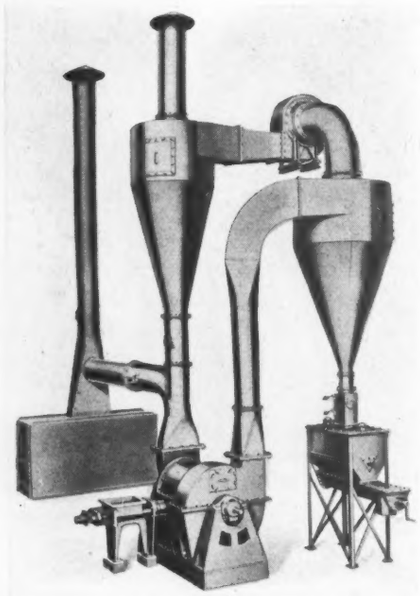
At the same time, the plant output was increased to such an extent over what it had been that the company was able to consolidate its operations in the one plant and dismantle the old dry process plant located beside it, with a consequent marked reduction in operating costs.

In addition to this installation, Oliver United Filters, Inc., also furnished filters for the Casebournes Cement Co., Ltd., in England; two plants of Asano Cement Co. and one for Onoda, all of Japan.

New Machinery and Equipment

Mill for Drying and Pulverizing

A MILL using the kiln-mill principle of drying and pulverizing in one operation that is capable of handling products of high moisture content is announced by the Raymond Bros. Impact Pulverizer Co., Chicago, Ill. The mill consists of an automatic feeding device, air separation system, concentrator collector, main exhauster, a vent fan, and welded seam steel pipe. The heater unit, either oil- or coke-fired, supplies automatically controlled heated air to the system. Products containing over 50% moisture have been reduced to powdered form in the unit, it is claimed. The entire operation from raw feed to finished product is dustless and automatic. This mill is particularly useful for washed clays in removing the moisture and recovering the clay in dry form; for handling china clay and kaolin; and for drying acid-treated clays for filtering purposes.



Handles materials with 50% moisture

●

Dragline Bucket

A NEW type U "Red Arch" dragline bucket by Bucyrus-Erie follows, in general design and special features, the type "X" Red Arch bucket introduced some months previously. According to the manufacturer, design, carefully selected steels and all-welded construction are combined to give light weight. Its joints cannot weave, it fills easily, and it dumps cleanly, the manufacturer states.

Pulverizers

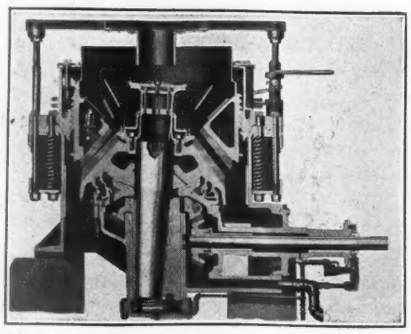
THREE new pulverizing units have been announced by the Babcock and Wilcox Co., New York, N. Y. These are the B and W type B pulverizers for closed-circuit operation on raw material, for closed-circuit operation on cement clinker, and with integral feeder and blower, for direct firing of cement kilns. Material is pulverized by three sets of balls and grinding rings. Classification is accomplished by an external air separator operating in closed circuit with the mill. Raw materials 1½ in. and under are reduced in one operation for rotary kiln burning. Power requirements are said to be 50% less than with usual preliminary and finishing mills for the same purpose. Very low oil consumption is also reported. The pulverizer for clinker has also demonstrated interesting economies, it is claimed.

The unit for direct firing of kilns provides positive control over combustion conditions and is self-contained. An installation on a 1000-bbl. wet-process kiln is said to have reduced coal consumption 15%. Advantages claimed include saving in capital investment and reduction in cost of operating labor. For plants preferring central-pulverizing bin system a type B pulverizer of the air-separator type has also been developed. Grinding pressure is adjustable, so continuous fineness and capacity can be maintained. The pulverizer is adapted to the use of preheated air as the drying separating medium. It is made in capacities up to 50 tons per hr.

●

Fine Reduction Crusher

A SHORT HEAD fine reduction crusher is announced as a new development of its Symons cone crusher by the Nordberg Manufacturing Co., Milwaukee, Wis. The principal changes are the shape of the crushing cavity and a different design of head and bowl. Much of the initial crushing may now be done at the top of the cavity and travel through the cavity is faster, increasing capacity, it is claimed. The crusher is built in 3-, 4-, 5½- and 7-ft. diameter cones, and will produce a minus ¼-in. product.

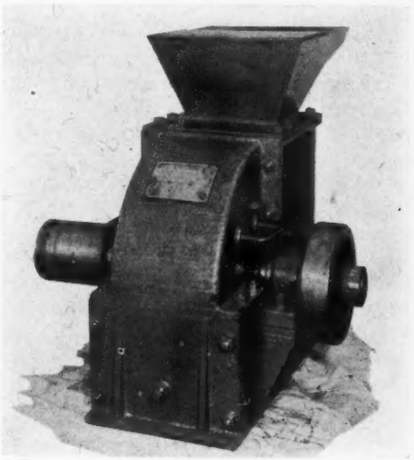


Crushing cavity, head and bowl altered

●

Pulverizer

AN IMPROVEMENT to its "Pulverator" is announced by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis. This is the application of anti-friction bearings. Besides improving efficiency, vibration is reduced to some extent, and for wet applications an effective seal against dirt and water is obtained. For wet crushing applications a water slinger is available.



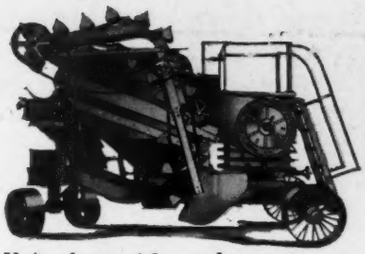
Anti-friction bearings now standard

●

Portable Plants

ANNOUNCEMENT is made by the Universal Crusher Co., Cedar Rapids, Ia., of a diversified line of portable crushing units to meet requirements of all types. These portable units may be used in conjunction with existing equipment in commercial plants or may be used as separate producing units. One unit conveys to a 6-ft. single deck gyrating screen. Oversize drops to a crusher and is returned to the screen for sizing. The sized material is delivered to a hopper, from which it is discharged to truck, storage bin or stock pile. The unit is powered by a 60-hp. gas engine and has produced up to 150 tons per hr.

The company has also developed dual plants, in which a jaw crusher is used for primary crushing and either jaw crusher or



Unit plant with crusher and screen

rolls for secondary. Dual plants are built similar to unit plants, except that a double deck screen replaces the single screen, and flow is designed accordingly. Both unit and dual plants can be supplied in three units where weight must be kept low. By varying the size of production units in these plants various capacities and requirements are taken care of.

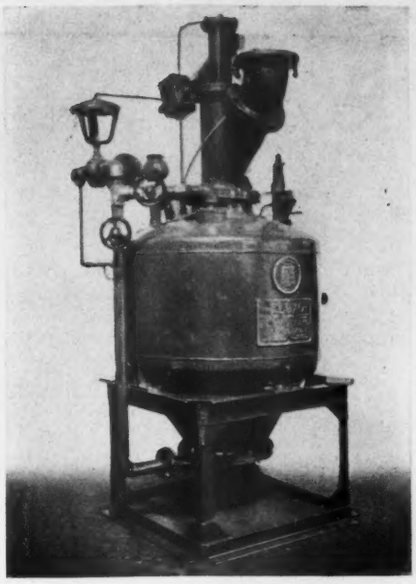
Another unit that has been developed is a complete self-contained unit with feeder conveyor, screening and crushing unit, delivery conveyor and power unit with V-belt drive mounted on a single goose-neck truck. No bucket elevators are used. This outfit may be set close to the pit and operated at any angle to suit the development desired.

•

Pneumatic Transport System

A DEVELOPMENT in pneumatic transport systems is announced by F. L. Smidth and Co., New York, N. Y. Special features of the "Flexo" pump, which provides motive power for the material, are that it eliminates mechanical feeders, it eliminates adjustments and attendance when quantity of the feed changes, and it eliminates deck slabs of the silo structure.

The pump is made in two types; suction feed and gravity feed. It operates through pressure tanks, into which the material is drawn by vacuum or gravity, following which it is expelled under pressure. In this way no moving parts are in contact with the material being transported. The pump units are mounted on a low platform truck for portability, but may be had for stationary installation. Among applications for these pumps are: (1) Conveying pulverulent materials from grinding mills to silos, blending bins, or packing bins; (2) conveying dust collected to silos or packing bins; and (3) conveying pulverulent materials when shipped in bulk from cars to storage. Possible applications are shown in accompanying views.



Gravity feed pump for pneumatic conveying

•

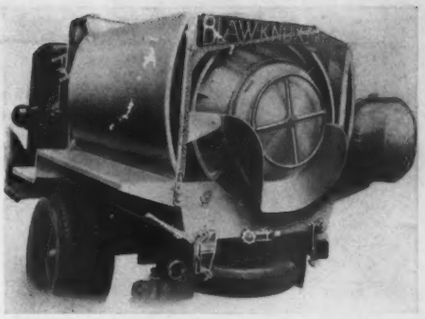
Describes New Conveyor

TWO NEW BOOKLETS have just been issued by the Stephens-Adamson Manufacturing Co., Aurora, Ill., describing the "Redler" continuous flow conveyor, a new departure in conveying equipment. These conveyors mechanically convey bulk materials horizontally, vertically, up inclines and around corners.

•

Truck Mixer and Agitator

THE Blaw-Knox Co., Pittsburgh, Penn., announces a new line of "Trukmixers" and agitators. A Hercules gasoline engine operates the mixing drum. Charging and discharge doors are large and fitted with rubber gaskets. Mixing blades have been designed and placed for quick mixing and discharge. Dual mixer controls provide control at the rear or at the driver's seat. Water is measured by an overflow system. Flow is by gravity, but a water pump may be added. Aluminum alloy castings are used to reduce weight and anti-friction bearings to reduce friction, power consumption and wear.



Neat appearance is included

•

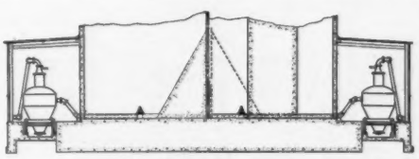
Crawler Dump Wagons

A 3-WAY crawler dump wagon especially adaptable to stripping requirements is announced by the Trackson Co., Milwaukee, Wis. These units have capacities of from 7 to 10½ cu. yd. Body is of ¼-in. high carbon steel, tops of all gates are double flanged and reinforced, and side gates are topped with wood buffers encased in steel. A hydraulic front end jack is standard.

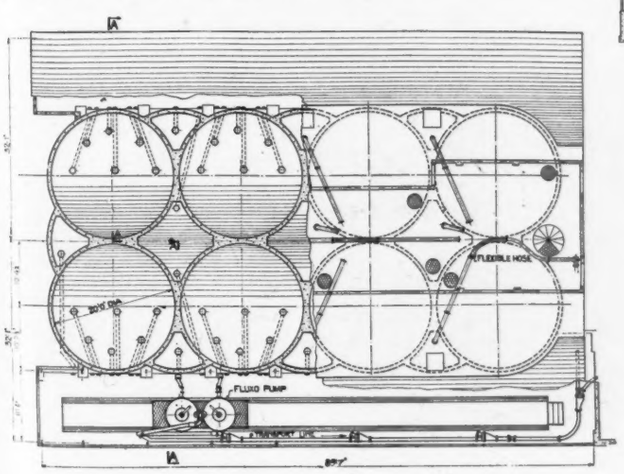
•

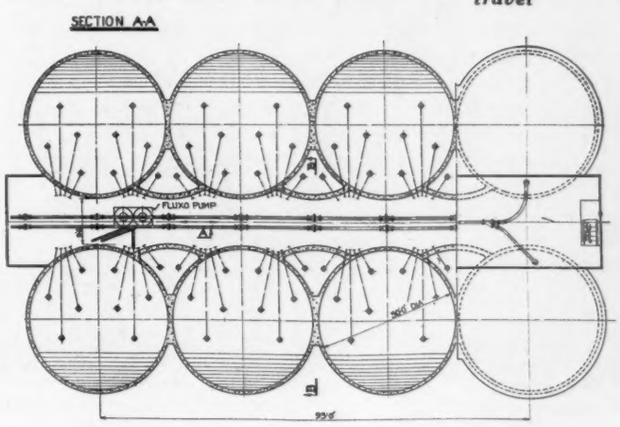
Renewable Lip Bucket

THE American Manganese Steel Co., Chicago Heights, Ill., announces a one-piece renewable lip bucket. The digging front can be renewed in the field without riveting. Different types of lips are available for



Section A-A through bins at left, with pumps installed in lean-to's. Below—Space between bins used for pump travel





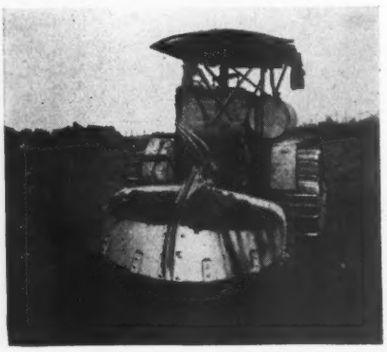
Removing lip of bucket

various requirements. The bucket is now being made in sizes from ⅜ cu. yd. to 2 cu. yd. capacity and soon will be available in sizes up to 4 cu. yd.

●

Bucket for Tractor Operation

ANNOUNCEMENT of a "Crescent" scraper bucket for use behind a tractor is made by Sauerman Bros., Inc., Chicago,



Controlled from tractor

Ill. This scraper is designed for attaching to the draw bar of tractors, and is equipped with a hydraulic ram. Loading and dumping is controlled at the driver's seat. It is manufactured in several sizes.

●

New Powder in Cartridge Form

A NEW POWDER designed especially for coal mining is announced by the Atlas Powder Co., Wilmington, Del. This blasting agent, "Blakstix," was designed to eliminate checking or destruction of the fiber of coal resulting from violence of the force of the explosive used. It is claimed to effect a distinct saving in blasting costs as well. Reduction in smoke and fumes is also obtained, it is said. It is packed in a new spirally wound glued shell to increase moisture resistance.

●

Convertible Shovels

THE Ohio Power Shovel Co., Lima, Ohio, announces a complete line of convertible shovels ranging in size from ¾ to 1½ cu. yd. All of the machinery, including cone rollers, operate on roller bearings; all gears have helical cut teeth; synchro power clutch is of a new design; all operations are independent; operating levers are mounted on square shafts; and drums are of extra large diameter. Extra long crawlers can be applied when conditions require. All main shafts on which are mounted sliding members are spliced for accuracy and fit. The shovel is particularly designed for quiet and frictionless operation, the manufacturer states.

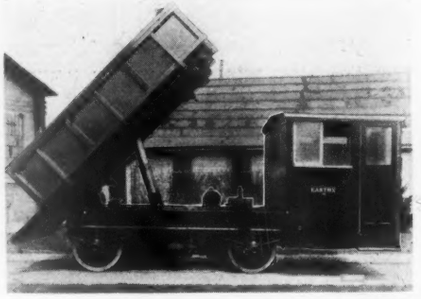
Helical cut gears and synchro clutch employed

made in other sizes. It will carry 15 tons. A new type brake improves operation.

●

Combines Locomotive and Car

A SELF-PROPELLED one-man-operated car is announced by the Easton Car and Construction Co., Easton, Penn. The car is equipped with a three-way hydraulically



Three-way dump adds flexibility

dumped body directionally controlled from the cab to either side or end. The rated capacity is 12 cu. yd., although it will be

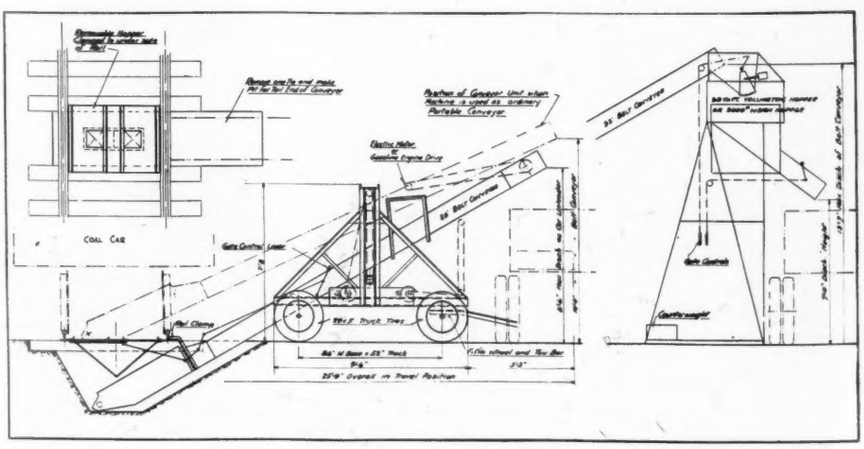
Cutting Attachment Improved

THE Linde Air Products Co., New York, N. Y., announces an improvement in the "Oxweld" type CW-17 cutting attachment whereby the heating oxygen throttle can also be used as an oxygen shut-off valve for use during temporary stops in cutting. The throttle has been redesigned.

●

Portable Car Unloader

A PORTABLE car unloader is announced by the George Haiss Manufacturing Co., New York, N. Y. The machine is mounted on rubber tires so it can be hauled as a trailer. It has a raising and lowering device and may be operated in track pit or level with the ground. Complete equipment includes track hopper with feeding gate and controls to regulate flow to the conveyor. It is made in 25-, 30- and 35-ft. lengths. A 30-cu. ft. volumetric hopper or a weighing hopper for batching is available.



Typical installations of portable car unloader

Pacific Coast Cement Merger Pending

IMMINENCE of the largest cement consolidation yet brought about in coast territory directs particular attention to the industry at this time, writes H. C. Hendee, in the Pacific Coast edition of the *Wall Street Journal*. While terms for the assembling of assets of four companies under a $20,000,000 Standard Cement Co. remain for promulgation, much of the background which has brought about the tentative understanding in northern and central California territory is apparent.

Reasons for a consolidation have been long existent and have been brought to focus in the last three years by the decline of cement demand, competitive conditions and savings which can be obtained in unified operation.

The four companies which it is proposed to join, so far as cement manufacturing assets and raw material resources are concerned, are Pacific Portland, Calaveras, Santa Cruz Portland and Yosemite. If and when this consolidation is brought about, there will remain in the competitive territory the Monolith Portland Cement Co. and the Henry Cowell Lime and Cement Co. The merger will combine plants with a present capacity of about 23,000 bbl. daily. Monolith has a capacity of about 4500 bbl. daily in California in addition to control of an 1800-bbl. plant at Laramie, Wyo., through a subsidiary, which plant, however, is not a factor in California business. Cowell's plant at Mt. Diablo has about 2000 bbl. daily capacity.

Outside these companies Riverside Cement, with 13000 bbl. daily capacity, California Portland and Southwestern Portland have been factors largely in southern California. A gentleman's agreement has for some time existed by which north and south makers have not taken competitive hand except in their own natural territories.

Trend of actual prices of cement in bulk and sacks, f.o.b. mill, under large contract may be judged from the federal contracts thus far made for Hoover dam. Five companies have figured in this business. Awards this year have been:

	Company	Amount, barrels	Price, bbl. f.o.b. mill
Jan. 5.....	*Syndicate	{335,000 (b) { 5,000 (s)	$1.28 1.78
Jan. 5.....	Union Port. Cem.	40,000 (b)	1.12
Aug. 15....	Union Port. Cem.	10,000 (s)	1.75
Sept. 8.....	Riverside	50,000 (s)	1.55
Sept. 26...	*Syndicate	332,500 (b)	1.24
Sept. 26...	Union Port. Cem.	67,500 (b)	1.04

*Riverside, California Portland Cement. Southwestern and Monolith. (b) Bulk. (s) Sacked.

Awards on this business amount to 840,000 bbl., leaving an estimated 3,160,000 bbl. required for future construction.

In the foregoing awarded prices it is important to note that they represent mill prices, although delivered prices are normally quoted in general cement business.

As to the general prospect of coast volume, it would seem that with the largest outlook for orders in big construction ventures, the low point in cement production in California may have been reached this year. In addition to the more than 3,000,000 bbl. still needed for Hoover dam, the Metropolitan Water District viaduct and tunnel work, it is estimated, will take 6,000,000 bbl., the San Francisco-Oakland Bay bridge 1,300,000 bbl. and the Golden Gate bridge about 500,000 bbl. There is also the All-American canal project to Imperial county, which will probably require a large amount of cement when ultimately put under construction.

Out of these projects which presumably will be in construction over the next five to seven years, from 1,000,000 to 2,000,000 bbl. of cement yearly might logically be expected to be added to general construction orders in this territory. From a general construction standpoint, some slight upturn in business also appears possible for 1933.

One indicated advantage from an outside standpoint in the consolidation probably will be listing of the stock of the new Standard Cement Co. on coast markets and some relaxation of the high degree of conservatism in respect to corporate information, a policy which has grown from the extreme state of competition and the desire of each company to keep from its competitors operating and other data.

British Cement Imports Held Up

ADVANCE of 29 c. per bbl. in the price of portland cement in the greater New York territory, including northern New Jersey, Westchester county and Long Island, will have the effect of putting the local quotation in line with the level in other parts of the country. The action was made possible by the recent order of the New York Customs Appraiser, who in November issued a notice of suspicion of dumping of British cement into the United States, following allegations by the domestic industry Commissioner Eble. An investigation is now under way; and if dumping is finally proved the British cement will be charged additional duties sufficient to advance the quotation of their product here to the British market price.

In the meantime, under the customs order, a bond is required in the amount of the value of each shipment of such cement to guarantee the ability of the importer to pay an anti-dumping penalty if such a verdict results.

Windshield Sticker Fights Diversion

A WINDSHIELD or rear window sticker for automobiles has made its appearance during the last few days, advocating the spending of the gas tax for roads only. It is attractively printed in red and blue and carries the following message on the back:

USE MOTOR TAXES FOR ROADS ONLY!

Motor taxes were created to pay for the roads and streets on which you drive your car—and for that purpose *only*. Your mileage costs are *less* when you drive on improved highways. *This pays your motor tax* as long as the road money is spent for improving the highways, the main city streets and county roads.

Now it is proposed to divert this money from job-giving road work to other purposes —to general public expenses which *everybody* should help to pay.

Motor taxes become *class* taxes when they are used for other than the improvement of the motorists' roadway. Misuse of highway funds will add thousands to the unemployed ranks. *You* will get less benefit for your motor taxes and so will the workingman.

Let your Public Officials know you want *all* of the *gas tax* and *license fee money* spent for improving highways—

AND NOTHING ELSE!

Both the Workingman and the Motorist Will Benefit.

The Portland Cement Association and a group of other organizations sponsor the sticker. Write the association, at Chicago, for copies.

Red-white-blue sticker for automobile windshields

Arthur Charles Tagge

ARTHUR CHARLES TAGGE, one of the best known and most beloved men of the cement industry, died December 6, at his home in Monroe, Mich., as the result of a heart ailment with which he had suffered for some time.

The greatest number of Mr. Tagge's acquaintances knew him as the brilliant engineer and able operating executive who later became the distinguished president of the Canada Cement Co., Ltd. But to many others of his intimates, he was known as the lover of art and flowers, the exponent of simple honesty and simple living, and a friend the latchstring to whose heart and hearth were always extended.

Mr. Tagge's career was noteworthy as much for the versatility of his talents as for his unusual achievements in his chosen field. He was at once a great student, an educator, an engineer and an executive. The Canadian edition of Who's Who devotes an entire page to the record of his life. A man well read along many lines, including some most remote from the fields of his life work, he was ever unassuming and easily extended the warmth of a genial and sympathetic personality to the humblest worker. Hundreds of such mill employes knew him intimately and treasure his memory.

He was born at Ann Arbor, Mich., in 1870. His work at the University of Michigan was interrupted before graduation, Mr. Tagge taking a position as a school teacher at Monroe, where he later became principal of the high school. He returned to the university and completed his course in engineering in 1897.

The following year he secured a position with the Link-Belt Machinery Co., remaining two years. He went from there to the Osborn Engineering Co. of Cleveland. His unusual ability won him the positions of erecting engineer and superintendent for the Peninsular Portland Cement Co. in 1901 and 1902.

Mr. Tagge then became associated with the group which formed the International Portland Cement Co., of Ottawa, Ont., and remained with that concern for three years in the capacity of engineer and operating advisor. He then became associated, in a similar capacity, with the Western Canada Cement and Coal Co. A few years later, when the Canada Cement Co., Ltd., was formed as a consolidation of the principal cement plants of the Dominion, Mr. Tagge became general superintendent. The consolidated company operated a chain of 14 plants, then the most extensive cement mill operation of any single corporation, and Mr. Tagge distinguished himself in the work of standardizing and securing greater economy of operation.

He subsequently became general manager and later vice-president and director. After six years as vice-president, Mr. Tagge was elected to the presidency of the company

A. C. Tagge

in 1927, succeeding F. P. Jones. As president he directed the very outstanding program of rehabilitation which the company has carried out, entirely rebuilding a number of its principal manufacturing units and modernizing others.

On his retirement from the presidency of the Canada Cement Co. two years ago, he remained a director, but announced his retirement to a new home at Monroe, where he could enjoy his flowers and art treasures and entertain his friends. A year later he was unanimously elected an honorary member of the Portland Cement Association, being one of only three men who have ever been accorded this distinguished recognition.

During his active years in the cement industry Mr. Tagge held many important committee appointments in the Portland Cement Association, the most outstanding of which was his long chairmanship of the committee on accident prevention and insurance, during which the foundation was laid for the campaigns which have since brought cement to first place among American industries for reduction of accidents.

Elect E. J. Hayden President

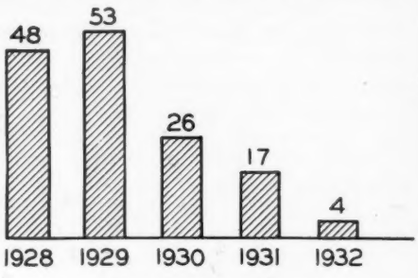
AT THE annual meeting of the International Acetylene Association E. J. Hayden, central division manager of the Linde Air Products Co., Chicago, Ill., was elected president. He had been vice-president. H. B. Pearson, Compressed Industrial Gasses, Inc., Chicago, was elected vice-president.

A subject given particular consideration and one in which much interest was shown was "How the Steel Industry Uses Hard Facing." While this is a comparatively new development with the steel industry a short survey of one plant led to 27 commercial applications, all of which proved to be successful, it is reported.

November Accidents

DURING November, 1932, the operating plants within the membership of the Portland Cement Association reported only four lost-time and no fatal accidents. These figures again reflect the low rate of operation as indicated by the October statistics of the U. S. Bureau of Mines, showing a total of less than 15,000 men at work in mills where normal occupation requires forces totaling about 40,000. Nevertheless, the November accident total was extremely gratifying as compared with 14 lost-time accidents suffered in October, 1932, and 16 accidents, one fatally, in November, 1931.

The most severe accident of the month occurred to the operator of a quarry locomotive who climbed underneath to inspect the brake gear. He was lying with one hand braced against the rail when the loco-



November accidents

motive moved a short distance, crushing the ends of two fingers before his hand could be removed. The movement evidently was caused by unevenness of the track.

The list of plants which have operated 1000 days or more without lost-time or more serious accident, is as follows, corrected to December 20:

(1) Lehigh Portland Cement Co., Iola, Kan. C. A. Swiggett, superintendent—2293 days.

(2) Alpha Portland Cement Co., Ironton, Ohio. F. C. Brownstead, superintendent—2203 days.

(3) Medusa Portland Cement Co., Toledo, Ohio. W. J. Worthy, superintendent—1719 days.

(4) Great Lakes Portland Cement Co., Buffalo, N. Y. A. T. Bevier, superintendent—1461 days.

(5) Canada Cement Co., Ltd., Pt. Colborne, Ont. L. M. McDonald, superintendent—1347 days.

(6) Medusa Portland Cement Co., York (White), Penn. R. J. Landis, superintendent—1194 days.

(7) Medusa Portland Cement Co., Manitowoc, Wis. F. E. Town, superintendent—1174 days.

(8) Canada Cement Co., Ltd., Fort Whyte, Man. V. C. Hamilton, superintendent—1117 days.

(9) Canada Cement Co., Ltd., Exshaw, Alta. W. D. Armstrong, superintendent—1110 days.

(10) Trinity Portland Cement Co., Ft. Worth, Tex. A. A. Chaney, superintendent—1103 days.

(11) Superior Portland Cement Co., Concrete, Wash. H. A. Ambler, superintendent—1061 days.

(12) Hercules Cement Co., Nazareth, Pa. J. S. Downs, superintendent—1043 days.

Sand-Lime Brick Production and Shipments in November

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick located in various parts of the United States and Canada. The accompanying statistics may be regarded as representative of the industry.

Twelve sand-lime brick plants reported for the month of November, this number being two less than the number reporting for the month of October, statistics for which were published in our issue of November 19.

Average Prices for November

Shipping point	Plant price	Delivered
Detroit, Mich.	$9.50-10.50	$10.50-11.50
Flint, Mich.	11.50	13.00
Grand Rapids, Mich.	.....	12.50
Medfield, Mass.	8.00	9.00-10.00
Milwaukee, Wis.	7.50	10.50
Mishawaka, Ind.	9.00	.....
Saginaw, Mich.	10.00	.....
Toronto, Ont., Can.	12.00	13.50

Statistics for October and November

	*October	†November
Production	2,187,175	900.500
Shipments (rail)	300,000	.....
Shipments (truck)	1,668,169	1,231,330
Stocks on hand	4,813,167	4,476,561
Unfilled orders	3,650,000	8,050,000

*Fourteen plants reporting; incomplete, six not reporting unfilled orders.
†Twelve plants reporting; incomplete, three not reporting unfilled orders.

To Develop Newfoundland Gypsum Deposits

THE International Gypsum Co., Ltd., has been incorporated in St. Johns, Newfoundland, with a capital of $1,750,000 in $1 par value shares to develop gypsum deposits at Flat Bay Brook on properties owned or controlled by Wm. H. Taylor.

Present plans are reported to contemplate mining and crushing crude gypsum which will be exported to plaster mills on the Atlantic coast and elsewhere. It is stated the company already has orders on hand from New York City manufacturers.

Details of New California Sand and Gravel Plant

THE PLANT of the California Rock and Gravel Co. now under construction at Eliot, Calif., will have a daily capacity of 1500 tons with provisions for expansion, F. W. Erlin, vice-president, advises.

Excavation from the pit will be by electric shovel, which will feed direct to a Stephens-Adamson belt conveyor. Belt conveyors will be used throughout the plant as well. Allis-Chalmers vibrating screens and gyratory crushers will screen and crush the material in the plant.

The deposit is of excellent quality, with few large boulders that cannot be handled by the primary crusher. There are 165 acres in the deposit and the material is of uniform nature to a depth of 45 ft. The small amount of overburden will be removed by washing rather than stripping. A deep well will supply water requirements.

Aggregates will be prepared to meet specifications of the state and of the city of San Francisco. All shipments will be by rail, and a spur is now under construction. It is planned to have the plant in operation early in March.

Officers of the company are: F. N. Woods, Jr., president; Frank W. Erlin, vice-president and general manager, and C. A. Roller, secretary, with offices in the Call Bldg., San Francisco. The plant was designed and is being built by A. D. Hadsel, designing engineer for the company.

O. P. Chamberlain

COLONEL Oscar Pearl Chamberlain, 62, was killed in an automobile accident December 10 when crossing a street in Chicago, Ill. Col. Chamberlain was well known in the rock products industry, having served as a director of the National Crushed Stone Association. For 27 years he was associated with Dolese and Shephard Co., from which he retired as president in August of this year. He had also served as general manager of the Union Paving Co. and as a director of the Woodland Clay Products Co.

O. P. Chamberlain

During the World War Col. Chamberlain started as major. He was promoted to lieutenant-colonel shortly after and in 1920 was made a reserve colonel. While in the service he supervised the construction of millions of dollars worth of military property.

Canadian Province Builds Plant for Agricultural Limestone

A GOVERNMENT-OWNED plant for producing agricultural limestone has been put in operation at Pugwash, Nova Scotia, Canada. In announcing the opening of the plant the provincial Minister of Agriculture stated that it would now be possible for the farmers to get limestone at greatly reduced prices. The plant was built after a survey of the district revealed that the amount of limestone used was considerable less than it should be, it is reported. Limestone will be sold for $3.00 per ton delivered and it is planned to handle all operations and sales on a non-profit basis.

Suggests Cement Imports as Trade Balance

ATTACKING northern California cement mills for a policy that is strangling trade in the port of San Diego, J. Fred Larson, San Diego shipping man, recently issued a warning that shipping in San Diego will waste further away.

He pointed out that members of the group have fastened a $2.50 per ton additional arbitrary rate charge on all San Diego water borne exports—with the sole exception of gypsum coming from Plaster City, Imperial Valley.

He suggested that 25% of our cement be imported from foreign countries. Thus a favorable trade balance could be set up and exports stimulated.—*San Diego* (Calif.) *Sun.*

Reduce Rail Rates on Flux Stone to Meet Truck Competition

AN IMPORTANT REDUCTION in the fluxstone (limestone freight rate) from the Hillsville-Bessemer district to Youngstown only was granted by the railroads December 14.

The new rate will be 42 c. a ton plus 10% "depression" charge against 55 c. plus 10%. The railroads agreed to the rate to meet truck competition. The rate to other Youngstown district points except Struthers will remain 55 c.—*Youngstown* (Ohio) *Vindicator.*

Concrete Paving Yardage

CONCRETE PAVEMENT yardage as awarded in the United States during November and for the period ending December 3, as reported by the Portland Cement Association, follow:

	Sq. yd. awarded during November, 1932	Total sq. yd. awarded for year to December 3, 1932
Roads	7,591,606	81,755,939
Streets	370,451	9,094,870
Alleys	39,770	327,297
Total	8,001,827	91,178,106

Mississippi Sand and Gravel Association Elects Officers

AT THE MEETING of the Mississippi Sand and Gravel Association held late in November, S. H. Livingston, president of the Southern Sand and Gravel Co., was elected president, and A. B. Arnett, of the Columbus Gravel Co. was elected secretary-treasurer. A successful meeting is reported.

A. B. Arnett, secretary-treasurer, Mississippi Sand and Gravel Association

Big Construction Program Will Lift Depression

AN EMPLOYMENT and business revival of gratifying proportions is in store for the United States, provided action is taken to make depression history repeat itself, is the view of A. C. Tozzer, president-elect for 1933 of the Associated General Contractors of America, in outlining questions to be taken up at that association's Detroit convention opening January 16, 1933. Mr. Tozzer is executive vice-president of the Turner Construction Co., New York City.

"The theory that something just turned up to pull us out of previous severe depressions is entirely unjustified by our economic history," claims Mr. Tozzer. "Something had to be turned up and this 'something' in practically every instance involved the launching of a huge program of construction."

The six-year long financial panic and industrial and agricultural depression of 1873 to 1879 is cited by Mr. Tozzer as the closest parallel to our present condition. Like the present one, it was a secondary post-war depression. It was preceded by a slowing up or stoppage of construction because finances were rushed to financial centers for quick profits in stocks and bonds, just as happened in 1928 and 1929. And for five years, Mr. Tozzer claims, the depression grew progressively worse; business leaders waited for something to turn up, construction stagnated and unemployment grew.

"That depression was broken and prosperity returned by the same methods that will have to be used now," he claims. "Credit resources were mobilized by the federal government, the states and municipalities, and placed behind huge construction programs. By means of land grants, franchises, cash grants and bonuses, a credit base for the construction of railroads and the resultant building of new cities and industries was created."

"To turn the tide of decreasing employment, buying power and business, only requires that we construct additions to our permanent national wealth now instead of later. Once that decision is made and courageous action taken in launching construction nationally in the volume that is needed, this country will climb out of present conditions far faster than out of previous depressions."

The program being urged by Mr. Tozzer is to be one of the central themes at the 14th annual convention of the Associated General Contractors of America to be held in Detroit, January 16 to 20, 1933.

Pennsylvania Stone Producers' Association to Fight for Highway Funds

THE special meeting of the Pennsylvania Stone Producers' Association, Harrisburg, Penn., December 15, was devoted to the discussion of the possible diversion of highway funds during the legislative session of 1933. The discussion was led by H. H. Wilson, chairman of the Pennsylvania Construction Council.

It was the unanimous opinion the Stone Producers' Association should work in close harmony with the Pennsylvania Construction Council and use every effort both individual and collective to defeat any attempts to use revenues from the Highway Department for purposes other than the construction and maintenance of highways under the jurisdiction of the Department of Highways.

On a motion by O. M. Graves, seconded by M. L. Jacobs, the Pennsylvania Stone Producers' Association increased its contribution to the Pennsylvania Construction Council to a total of $500.

A further motion was made by H. H. Wilson: "Resolved that the executive secretary be instructed to inform the membership that meetings of the entire construction industry of Pennsylvania will probably be called by the Pennsylvania Council the latter part of January, 1933, for the purpose of discussing the existing situation relative to the diversion of motor taxes and that all members be urged to spread this information to all elements of the construction industry and endeavor to promote the maximum attendance at these meetings when called. Such meetings will probably be held at Philadelphia, Pittsburgh, and Harrisburg."

H. E. Rainer, President, New York State Stone Association

THE ANNUAL MEETING of the New York State Crushed Stone Association was held at Syracuse, N. Y., December 16. The principal business of the meeting, aside from the election of officers for 1933, was to listen to a report by Thomas Wright, secretary of the New York State Construction Council, on the proposed state highway budget for 1933, which amounts to but $18,000,000, exclusive of federal aid. This is not finally settled, and the producers hope to see a larger appropriation.

The following officers were elected: President, H. E. Rainer, Federal Crushed Stone Co., Buffalo, N. Y.; vice-president, J. E. Cushing, Cushing Stone Co., Schenectady, N. Y.; secretary and treasurer, George E. Schaefer, General Crushed Stone Co., Rochester, N. Y.

H. E. Rainer, president, New York State Crushed Stone Association

Secretary Schaefer was presented with $100 cash and the heart-felt appreciation of the association for his unremitting services. The association will continue to direct the major part of its activities to assisting the New York State Construction Council in its fight for highway funds.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Prospects for Cement Products Improved by Developments of 1932

DEVELOPMENTS of fundamental importance have taken place in the cement products industry that will inevitably increase their use and acceptance. Many of these have been announced. Others are pending. While those now pending are in reality developments of 1932, the industry will think of them as developments of 1933. At least two of these unannounced developments are proved, in so far as their properties and economy are concerned, according to the originators.

Of general interest to most products men and slag producers was the announcement of two new light-weight aggregates, "Cellastone" and "Waylite." Present indications are that they will further extend the use of light-weight concrete in general. Manufacturers of building units, burial vaults, concrete pipe, concrete posts, cast stone and miscellaneous cast products are showing increased interest in the possibility of decreasing the weight of their products. These new slag aggregates have aroused considerable interest with them.

Concrete Masonry

Concrete masonry accounts for the largest volume of production, both in tonnage and value. The large reduction in building contracts has shown many manufacturers the urgent need to expand the market for standard units beyond foundation work. To assist in this, with sand, gravel and stone aggregate, some manufacturers have decreased web thickness. Size of the unit has also been increased to provide a block with 1 sq. ft. of wall surface area. This has enabled some manufacturers to meet competition of clay products as well as that of light-weight aggregate products.

Other manufacturers are promoting units of light-weight aggregate for their acoustical and insulation properties. Important projects have been sold during the year as a result. These include two outstanding broadcasting studios.

Concrete ashlar has been employed in most jobs of this type, and those who are considering the market possibilities for units of light-weight aggregate should not overlook the decorative possibilities which ashlar construction provides. Concrete masonry manufacturers have benefited during the year from the Federal specification for their product adopted in 1931, in that concrete masonry has been used on a greater number of Federal projects. It is probable that this type of work will offer the industry greater opportunity in 1933 than during the past year. A number of manufacturers have added the "Breeko" partition unit and thus have increased profits and volume.

Since this branch of the industry is dependent on construction, its business for 1933 will be influenced by its ability to serve the markets that develop. Outside of Federal work, in what direction is construction likely to turn? Most cities are well taken care of with commercial buildings. Most industries have ample capacity for the immediate future. Large apartments in the more expensive range report many vacancies. But there are many reports of an early shortage of homes in the inexpensive class.

Cheap Homes Most Likely Construction Market

There has been much effort to make it practicable for families with lower incomes to own homes. Steps to lower the cost of financing have been taken to this end. Factory production has been acclaimed to be an important factor in further reducing costs. As yet no practical design for a factory-made house has been developed.

In the meantime houses of concrete masonry have been built within the specified cost range—$2400 to $5000. The Architects' Small House Service Bureau has supplied plans for such homes of concrete masonry. The Portland Cement Association has published a book of suggested designs for houses to cost from $2700 to $6600, with the majority of the designs well under $5000. Because this type of construction does not eliminate architects, contractors and established building tradesmen; because it provides permanent, fireproof construction; because it permits individuality; because the cost is low; and because concrete masonry houses have been built that proved to have these characteristics, this market should provide an important outlet for concrete masonry in the immediate future. Great interest has been demonstrated in this development by the industry and it is not overly optimistic to expect a general public recognition during the coming year.

Extensive tests of concrete masonry, their assembly and publication by the Concrete Masonry Association during the past year, will prove most advantageous in winning this public recognition.

Pre-Cast Concrete Beams a New Product

Of further importance to the concrete masonry field is the introduction of pre-cast concrete beams which make it practicable to build fireproof concrete floors at a cost little higher than frame construction. This gives the concrete masonry plant an opportunity to specialize in fireproof house construction, in which much interest has been developed. A roofing tile machine, which is said to make a concrete roof tile that can be sold at a price competitive with wood or composition roofings, further increases this possibility.

In addition to the ability of established cement products to serve this market there have been a number of new types of construction developed for the low-cost house market, none of which are as yet being produced on a scale large enough to indicate their probable importance, in so far as public acceptance is concerned. The extent of their economy is also still problematical.

Concrete Brick

A development of much importance to manufacturers of concrete brick is the publication of a Federal specification for concrete brick by the Federal Specification Board. This should make it possible for concrete brick to compete on an equal basis

with clay brick on Federal projects. In addition to participation on important Federal construction, this recognition and acceptance should increase the establishment of this as an article of acceptable quality in the minds of architects, engineers and contractors who specify or use brick.

Cast Stone

The character of cast stone has been both advantageous and disadvantageous to it. Since it can be made in many hues and colors and with many finishes, it can be readily adapted to any architectural requirement. This offers the imaginative manufacturer opportunity to suggest individual effects that aid the architect in obtaining his desired result. At the same time it makes it difficult for specifications to be made specific that all manufacturers will bid on an equal product. Manufacturers are thus forced to interpret specifications so that they will not be eliminated by competition. This may result in a finish not in keeping with the architect's intent; a condition that has been unsatisfactory to both architects and manufacturers.

To correct this condition a set of standard samples in buff and grey, with bush hammered, rubbed, brushed and etched finishes, has been selected by the Cast Stone Institute, in cooperation with the Bureau of Standards, so that a finish may be designated by number. Competition for work on which these standard specifications are called for will thus be on an equal basis. The individuality of cast stone is retained for those who require or desire special material, yet the economy of cast stone of a definite quality is possible for those with whom that is a factor.

Concrete Burial Vaults

The sale of concrete burial vaults has continued to expand, but there has been great diversity in product. In some instances vaults of questionable quality have been made. A step that should result in improved quality of vaults was taken with the adoption of a tentative standard specification for concrete burial vaults by the American Concrete Institute and its approval by the National Concrete Burial Vault Association.

Concrete Pipe

Consumption of concrete pipe will largely be dependent on relief projects in 1933, as it was in 1932. Road construction programs were augmented as the result of emergency legislation. In a number of states concrete culvert pipe manufacturers enjoyed a busy year as a result. Sewer projects are proposed in a number of cities for the coming year and will proceed if funds are forthcoming from the Reconstruction Finance Corp. A number of communities have approved bond issues for such work, but little can be expected from publicly financed work until the market for securities improves.

Summary

Manufacturers of concrete blocks are increasing profits by making thinner webbed units, thereby lowering cost, and by making units with light-weight aggregate, enabling them to sell these units for their heat insulation and acoustical properties, thereby expanding their market and becoming increasingly competitive with clay products on certain types of work. Federal specifications are also opening new markets.

Concrete floor beams, non-loadbearing partition units, and low-priced concrete roof tile are new products that offer these manufacturers new business possibilities.

Business in 1933 will probably come mostly from Federal construction or construction financed by the Reconstruction Finance Corp., and from residential construction costing under $5000 per unit. It has been demonstrated that concrete masonry construction gives a higher quality house in this price range than is otherwise available, and manufacturers realize this and are actively promoting such jobs where possible.

A Federal specification for concrete brick should do much to add greatly to present consumption of this product.

The series of standard samples of cast stone will be of great benefit to the industry. The versatility of the material is not decreased, yet specifications may now be written to assure cast stone of a definite quality under a highly competitive system.

The manufacture of concrete burial vaults should be improved with approval of recognized specifications, whereby undertakers may demand definite quality and have a unit of measure of what they get.

The immediate prospect for concrete pipe is largely dependent on highway construction programs and an improvement in the market for municipal bond issues. Some business is in evidence as a result of projects sponsored as relief measures and financed by the Reconstruction Finance Corp.

Semi-Portable Sand and Gravel Plant

THE ACCOMPANYING SKETCH shows one of the latest productions of the Link-Belt Co., Chicago, Ill., and is described by its designer, C. S. Huntington, engineer of the company, as follows:

"This plant is to be used in locations to supplement the permanent plant equipment or in locations where permanent plants are not available. The several units will be built of steel, with the structure in convenient lengths and sizes so that it can be unbolted and transported from one location to another in ordinary trucks. We have not attempted to mount the machine itself on wheels, as we believe equipment of this kind is really too heavy to go into the location where such plants are used on their own wheels. However, with our arrangement the units can be bolted into smaller sections, to be handled conveniently on a truck and can be easily set up again, especially where there is a crane available to assist in the erection.

"The material in the pit would be excavated by some means such as a scraper, shovel or other machine and brought to the hopper by the scraper or in trucks or industrial type cars. The hopper would have a reciprocating feeder built as a part of the hopper which would discharge on to the first belt conveyor. This belt conveyor would discharge into a revolving scalping screen, where the oversize would be removed and sent to the crusher. The crushed stone would be returned by a second conveyor to the first conveyor and thus into the oversize screens a second time. The product going through the oversize screen would go to a revolving scrubber mounted on the same shaft as the scalping screen and driven by the same gearing. Scrubber would in turn discharge on to a double-deck vibrating screen. This screen would produce one or two grades of gravel as required and the product through the lower deck would be sand. The sand would drop into a dewater-

Semi-portable plant for sand and gravel producers

ing sand screw which would drain out the water and the silt and discharge the sand on to a belt conveyor. From under the screen structure three belt conveyors would be so located as to take up the two grades of gravel and the one grade of sand and discharge them into three storage piles on the arc of a circle. A crane operating inside these piles on the arc of a smaller circle could reach the material from any of these piles and place it in a batch hopper located at the center of the circle. From this trucks could transport it direct, or a mixing plant could also be located at this same point.

"It is arranged to drive the several units by electric motors; if commercial power is not available, a separate single gasoline engine generator unit would set at a convenient point alongside the plant and supply power for the several motors.

"The storage piles can be located as shown, relative to the screen structure, or the conveyors can be placed at another angle so as to place the piles at any point that is convenient. If the individual piles as discharged directly off the conveyor do not contain sufficient amount of storage, the crane can cast over and enlarge these piles, to give the desired capacity. In case ground storage piles are not desirable, these same belt conveyors could discharge into truck loading bins.

"It is not intended that this plant should compete with present permanent plants, nor is it being built to compete with the many so-called portable plants now on the market. The various units, in the way of belt conveyor idlers, the driving machinery, screens, scrubbers and dewatering screw conveyor, are standard units, the same as are now used in permanent plant construction. The main idea of this plant is to produce a plant which an operator or a contractor can use in a location where it will not pay to operate a permanent plant and which will give a capacity of from 75 to 125 tons per hour, depending upon the pit, and will give him an operation which will be free from trouble, as experienced in so many of the so-called portable type plants. These units are sufficiently strong and rugged and of sufficient capacity to give a continuous operation with a very minimum of trouble and upkeep."

Hermitage Adds Masonry Cement

THE Hermitage Portland Cement Co., Nashville, Tenn., announces it is now making a masonry cement which is claimed to be quick hardening and to have excellent working qualities. It is now being distributed throughout the trade territory of the company. This makes a third product for the company, as it is already manufacturing a high early strength cement in addition to its regular portland cement. Closed circuit grinding equipment was recently installed at its plant.

Sand and Gravel Association Convention Program

ANNOUNCEMENT of the 17th annual program of the National Sand and Gravel Association to be held in Detroit, Mich., January 17-18 has been made. The program is confined exclusively to matters of direct and immediate concern to the industry.

Tuesday, January 17

9:00 *A.M.* Registration.
10:00 *A.M.* Address of President Owens.
10:30 *A.M.* Five minute discussions by sand and gravel producers representative of different localities on: (1) What have been the conditions in the three principal markets in your locality during 1932 and what are the prospects for 1933; (2) what is the general competitive situation in your locality and what can be done to improve it; (3) what is the trend in your locality as between large and small plants, with particular reference to the future; and (4) what changes in production methods have brought about lower costs?
12:30 *P.M.* Luncheon.
2:00 *P.M.* "Prospects for a Ballast Market in 1933," by a prominent railroad official.
2:30 *P.M.* "Use of Separated Sizes of Coarse Aggregate in the Construction of Concrete Highways," by a Michigan state highway official.
3:00 *P.M.* "Competition of Local Plants and Methods of Meeting It," presented by Stanton Walker and discussed from the viewpoint of sand and gravel producers by a number of producers and from the viewpoint of the highway engineer by a speaker to be selected.

Wednesday, January 18

10:00 *A.M.* "Marketing Problems in the Sand and Gravel Industry," to be discussed by V. P. Ahearn from the aspect of methods which have been tried under existing laws to correct destructive competition, and a discussion of sales companies, mergers and the activities of local associations by speakers yet to be selected.
11:00 *A.M.* "What Revisions in Anti-Trust Laws Are Necessary to Permit Economic Planning in the Sand and Gravel and Allied Industries," by Wm. P. Belden, Cleveland, Ohio.
11:30 *A.M.* "Part Played by the Association in the Sand and Gravel Industry," by John Prince.
12:00 *M.* Report of Officers.
12:30 *P.M.* Joint Luncheon with National Crushed Stone Association, National Ready Mixed Concrete Association and the Manufacturers' Division of the three associations.
2:00 *P.M.* Inspection of Exhibits.
4:30 *P.M.* Report of Board of Directors and Induction of New Officers.
5:00 *P.M.* Adjournment.

Announce Program of Ready Mixed Concrete Association Convention

THE THIRD annual convention of the National Ready Mixed Concrete Association will be held at Detroit, Mich., January 17. The program for the convention is as follows:

Tuesday, January 17

9:00 *A.M.* Registration.
10:00 *A.M.* "Review of Work of the National Ready Mixed Concrete Association," by H. F. Thomson, vice-president.
10:30 *A.M.* "A Purchase Specification for Ready Mixed Concrete," by R. B. Young.
11:00 *A.M.* "Use of Ready Mixed Concrete in Highway Construction," speaker to be selected.
11:30 *A.M.* "Use of Ready Mixed Concrete in Cold Weather," speaker to be selected.
12:00 *M.* Report of Officers.
2:00 *P.M.* Open Forum, with five minute discussions by ready mixed concrete producers representative of different localities on: (1) How active was the demand for ready mixed concrete in your locality in 1932 and what are the prospects for 1933; (2) what is the general competitive situation, and what can be done to improve it; (3) what is your average haul; (4) is ready mixed concrete being used in street and highway construction in your locality; (5) what will be the trend with respect to use of agitators or truck mixers in the production of ready mixed concrete; and (6) does your company sell concrete on a guaranteed strength basis?
5:00 *P.M.* Adjournment.

Portland Cement Prices Increased

WITHIN the past three weeks the Alpha Portland Cement Co., Easton, Penn., and the International Cement Corp., New York City, announced price increases: Alpha raised prices 29c. per bbl. in the Ironton, Ohio, territory; the International 10c. per bbl. in the Limedale, Ind., and Bonner Springs, Kan., territories, and 29c. in the New York Metropolitan territory.

Rumor Sale of Universal Atlas Cement

THE FIRST PUBLICATION of a rumor current in the cement industry for many months appears in the *Atlanta* (Ga.) *Georgian* in the form of an International News Service report, which reads in part:

"Negotiations for the sale of the United States Steel Corp.'s cement business to enable the company to continue payment of its preferred dividends were reported in Wall Street recently."

How Road Building May Affect Demand for Rock Products in 1933

DEMANDS for stone, sand, gravel, cement and other materials for use in road building during 1933 probably will be considerably less than for 1932.

Some of the more apparent reasons are: Enormous diversions of state and county highway funds for relief and other uses other than road building; added dispersion of state highway funds to county and township units, subsequently spent in such a manner as to produce little road building; reduction in the gross income from vehicle licenses and motor fuel taxes; reduction in federal aid appropriations.

Gasoline tax diversions already have been accomplished in a number of states which, during recent years, have been among the leading road builders. With the idea of creating more hand work, states and counties in a number of instances have prescribed methods which have greatly decreased their paving yardage for the amount expended. During the first nine months of 1932 the use of gasoline as motor fuel declined about 7% and gasoline tax income declined about 5%. The extent of the reduction in federal aid for highways, although still unknown, undoubtedly will be very large. The emergency federal aid appropriation available for the present fiscal year will be entirely missing from next year's allotments.

Current tendencies make it safe to predict less activity on state primary road systems as a whole and a relative increase in proportionate attention to secondary roads and to some extent city streets which have been designated as parts of state routes. Indicative of the increasing interest in secondary roads is the increasing mileage of such types as single track concrete and cement bound macadam. Less labor and less material are required for secondary road improvement, mile for mile.

It is almost paradoxical to note the prospective large decrease in highway building, while the volume of motoring, taking the country as a whole, has declined only a few per cent.

Street paving is at low ebb and almost non-existent in many cities. This is due to the fact that city paving is generally financed by special assessment or out of the general taxes or bond issues, all of which sources are in disfavor with the public. Consequently little street paving can be expected until present economic conditions have improved materially.

These conditions are responsible for a state of turmoil and change far greater than anything of the kind ever experienced in the highway field. The outlook for the coming year is for a considerably lower volume of highway business: both national and local situations are too confused and indefinite to permit nay prediction of a more definite nature at this time.

Railroads Ask Continuance of Emergency Freight Rates

WITH INDUSTRY GENERALLY suffering equally with the railroads from the depression, it is expected that the Interstate Commerce Commission will receive a large number of protests against the petition of the carriers to continue emergency rates after March 31. Hearings probably will be held at an early date on the petition, formally filed by the railways on December 10.

Alpha Plant Completes Six Years Without Accident

THE Ironton, Ohio, plant of the Alpha Portland Cement Co. has completed its sixth year without a loss time accident. This is the second plant in the United States to complete six consecutive years without accident. The Ironton record is especially good since it obtains raw material from a mine, which is generally considered more hazardous than quarry operations. In a letter from President Brown to F. C. Brownstead, superintendent, he said in part:

"I know that the element of luck may have a good deal to do with an accident-free record for a single year. An accident-free record of six years, however, can only be obtained through continuous care and unflagging interest in accident prevention on the part of everyone connected with the plant. It is my sincere hope that it will be the pleasure of the president of this company to write you a congratulatory letter of this nature for many years to come."

Twenty-Eighth Annual Convention of the Sand-Lime Brick Association

SUBJECTS dealing with developments of value in winning new business will be given much attention on the program of the twenty-eighth annual meeting of the Sand-Lime Brick Association to be held in Detroit on January 17. Those subjects of particular interest include "Sand-Lime Block Production and What It Meant to Two Detroit Manufacturers," by Joshua Finkbeiner, Michigan Pressed Brick Co.; "Injection of Sugar Into Sand-Lime Brick," by Gerald J. Cox of Mellon Institute; and "Detroit's New Building Code and Its Relation to Other Building Codes Throughout the Country," by Theron Tayler, Campbell Stone Co. In addition to these there will be a round table discussion of general problems, including 1932 costs of production. There will also be the routine business of the association, such as reports of officers and committees, appointment of convention committees and election of officers.

Wisconsin to Build Over 300 Miles of Concrete Roads in 1933

WISCONSIN will build from 300 to 350 mi. of concrete roads in 1933, John T. Donaghey, state highway engineer, reports.

Mr. Donaghey said the highway commission has already authorized 140 mi. of concrete for next year and additional funds anticipated make it reasonable to expect a total before the season is over of close to 350 mi. The 1933 estimate is exclusive of the 120 mi. of uncompleted emergency federal aid work carried over until spring.

Commenting on the diversion of highway funds to other uses, Mr. Donaghey said the highway commission believes that revenues received from the motor vehicle tax and other similar sources should be used for highway purposes. He urged the contractors to take steps to counteract a movement in congress to eliminate future federal aid for road building.

Rules Cement Company Can Charge Truck Operators Higher Price

TRUCK OPERATORS of Pontotoc county, Okla., probably will appeal from a ruling of Orel Busby, Ada district judge, in which he held the Oklahoma Portland Cement Co. could charge truckers a higher price for cement than is charged in case of shipment by rail.

Judge Busby, assigned in Oklahoma City for the week, said the suit was brought in an attempt by the truck operators to force the price of cement down 15c a bbl. The evidence he said, showed the company charged an extra 15c a bbl. for all cement sold at the company plant to truck operators.

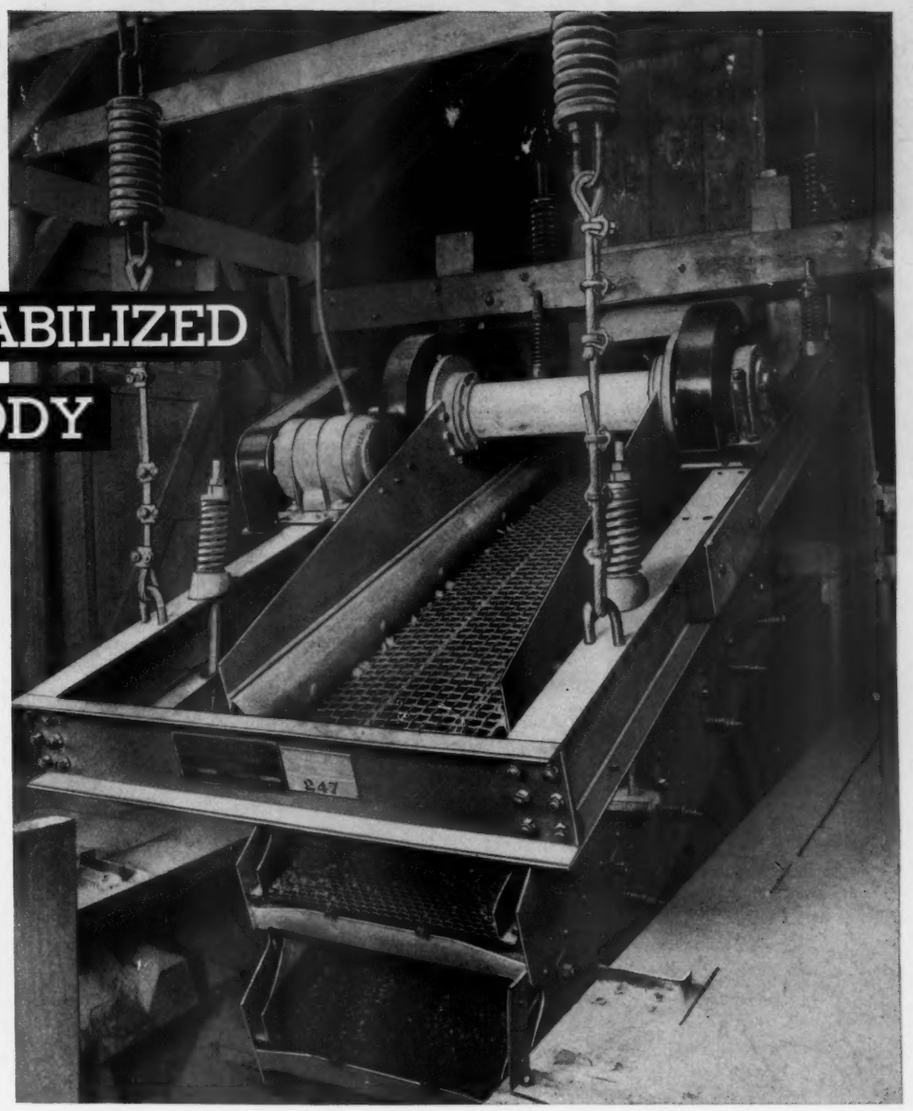
The plaintiffs alleged they were discriminated against in favor of railroads, while the company contended it costs more to handle orders of the individual truckers and were entitled to more money.

Judge Busby's ruling held the operators could obtain cement from other plants and therefore the action of the cement company was not discriminatory.—*Oklahoma City* (Okla.) *Times.*

Oklahoma to Have Big Road Program

OKLAHOMA'S $4,500,000 federal emergency road construction program, long under discussion, will get under way with the beginning of 1933, it is announced. Bids will be opened December 20 on road and bridge projects estimated to cost $1,000,000, and other large lettings will follow. The outlook for road construction in the neighboring states of Texas and Arkansas are said to be good.

SPRING STABILIZED SCREEN BODY



3' x 10' Type B Centrifugal Vibrating Screen in a commercial stone plant, showing suspension of screen body to frame. Spouts removed to show screen better.

The new Allis-Chalmers Type B Centrifugal Vibrating Screen incorporates a new method of supporting the screen body . . . . four compression springs, one at each corner. The balancing of the entire weight of the screen body and all moving parts removes this weight from the bearings and also forms a hanger for the screen body. The driving mechanism may be removed without disturbing other parts. The top deck and the other decks are entirely free from any obstruction, permitting free discharge.

Another feature of the Type B screen is the method whereby the proper crowning of the wire can always be maintained or changed to suit operating conditions and the thickness of the wire used.

These and other features were incorporated in the Type B screen after exhaustive shop and commercial tests which proved, among other things, a considerable saving in starting and running power. If you believe in plant rehabilitation it will pay you to investigate the possibilities of these screens and other Allis-Chalmers crushing plant equipment.

ALLIS-CHALMERS

VIBRATING SCREENS

Crushing Plant Machinery

Crushers (Gyratory, Jaw, and Fairmount Single Roll)
Crushing Rolls
Elevators, Conveyors, Feeders, and Bin Gates
Electric and Friction Hoists
Mobile Crushers and Auxiliaries
Screens (Revolving & Vibrating)
Scrubbers and Washers
Sizers (Multi-roll)
Motors, Pumps, and Texrope Drives
Complete Crushing Plants
Complete Sand and Gravel, Washed Stone, Agricultural Limestone, Oyster Shell, etc., Plants
Cement Plant Equipment
Lime Plant Equipment

Portland Cement Production

THE PORTLAND CEMENT INDUSTRY in November, 1932, produced 6,462,000 bbl., shipped 4,782,000 bbl. from the mills, and had in stock at the end of the month 18,764,000 bbl. Production of portland cement in November, 1932, showed a decrease of 20.8% and shipments a decrease of 33.2% as compared with November, 1931. Portland cement stocks at mills were 15.5% lower than a year ago.

The statistics here given are compiled from reports for November, received by the Bureau of Mines, from all manufacturing plants except three, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants both at the close of November, 1932, and of November, 1931.

RATIO (PER CENT) OF PRODUCTION TO CAPACITY

	November		Oct.	Sept.	Aug.
	1931 Pct.	1932 Pct.	1932 Pct.	1932 Pct.	1932 Pct.
The month	37.2	29.1	34.6	36.9	34.2
12 months ended	44.4	29.0	29.6	30.6	32.1

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES, IN BARRELS*

Shipped to	Sept., 1932	1931—October—1932	
Alabama	19,699	50,940	27,450
Alaska	660	808	264
Arizona	16,834	27,780	15,107
Arkansas	19,613	40,635	22,307
California	361,507	580,258	376,227
Colorado	59,394	86,048	38,567
Connecticut	63,306	162,540	71,770
Delaware	17,278	27,187	26,516
District of Columbia	119,017	122,498	113,725
Florida	28,320	51,252	37,713
Georgia	72,034	162,410	126,372
Hawaii	26,747	21,468	25,189
Idaho	5,582	15,481	12,068
Illinois	779,476	856,580	694,410
Indiana	441,616	313,599	344,533
Iowa	563,793	209,676	454,027
Kansas	92,223	166,235	120,451
Kentucky	227,296	149,282	228,086
Louisiana	193,661	485,188	174,155
Maine	29,894	46,894	27,528
Maryland	190,030	291,938	140,141
Massachusetts	202,039	344,866	161,602
Michigan	659,003	461,985	501,301
Minnesota	390,343	242,908	232,531
Mississippi	31,357	23,656	45,566
Missouri	441,547	481,965	370,436
Montana	28,855	21,927	16,038
Nebraska	134,212	194,514	149,984
Nevada	77,744	18,440	59,278
New Hampshire	51,276	51,874	52,384
New Jersey	263,670	645,068	272,420
New Mexico	10,703	25,380	16,950
New York	1,210,601	2,096,119	1,128,337
North Carolina	24,053	59,103	32,846
North Dakota	28,640	17,110	28,437
Ohio	678,551	749,570	586,904
Oklahoma	127,325	174,121	116,502
Oregon	44,597	91,480	47,454
Pennsylvania	500,591	781,503	491,038
Porto Rico	2,775	4,515	9,875
Rhode Island	17,542	54,139	39,206
South Carolina	8,681	243,408	14,526
South Dakota	107,588	29,736	77,355
Tennessee	52,157	111,024	121,927
Texas	310,541	542,920	372,878
Utah	11,733	22,669	26,380
Vermont	29,887	32,942	17,857
Virginia	85,343	122,618	72,578
Washington	140,586	157,064	90,017
West Virginia	119,731	142,876	72,893
Wisconsin	459,686	389,339	290,171
Wyoming	11,247	10,638	10,954
Unspecified	104,040	121,253	109,019
	9,694,624	12,335,427	8,712,250
Foreign countries	34,376	24,573	30,750
Total shipped from cement plants	9,729,000	12,360,000	8,743,000

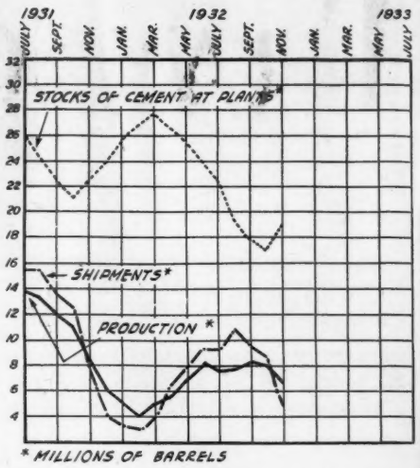
*Includes estimated distribution of shipments from three plants each month. †Revised.

Exports* and Imports†

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

IMPORTS OF HYDRAULIC CEMENT IN OCTOBER, 1932

Imported from	District into which imported	Barrels	Value
Belgium	Los Angeles	50	$ 50
	Oregon	605	407
	Porto Rico‡	2,122	1,790
	Total	2,777	$ 2,247
Canada	Maine & N. H.	32	$ 105
Denmark	Porto Rico	22,935	16,264
France§	New York§	519	908
Germany	Los Angeles	6	32
Japan	Hawaii	4,403	2,221
United K'gd'm	New York	29,717	19,856
	Grand total¶	60,389	$41,633



Production and shipments of cement

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1931 AND 1932

Month	1931—Exports		1932—Exports		1931—Imports‖		1932—Imports	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	41,199	$115,678	36,704	$82,984	95,609	$120,298	14,375	$16,648
February	25,703	88,989	12,889	39,350	21,984	25,391	83,706	69,197
March	54,599	144,579	39,105	81,856	70,378	80,360	19,173	17,215
April	40,478	116,564	30,123	69,451	53,333	58,576	59,392	41,487
May	48,028	140,953	31,634	71,048	19,325	20,568	9,223	7,358
June	43,597	107,610	33,134	72,084	32,079	42,955	20,963	15,496
July	29,344	97,837	18,872	54,814	14,332	15,582	31,518	24,904
August	39,517	106,643	25,110	48,961	8,895	11,739	78,600	60,474
September	27,570	81,399	35,270	63,018	33,574	33,520	69,258	51,570
October	24,531	68,524	28,756	52,922	39,642	42,380	60,389	41,633
November	33,200	97,796	.....	.....	27,940	22,235	.....	.....
December	21,887	54,028	.....	.....	40,147	34,314	.....	.....
	429,653	$1,220,600	.....	.....	457,238	$507,918	.....	.....

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT IN NOVEMBER, 1931 AND 1932, AND STOCKS IN OCTOBER, 1932, IN BARRELS

BY DISTRICT	Production 1931	Production Nov. 1932	Shipments 1931	Shipments Nov. 1932	Stocks at end of month 1931	Stocks at end of month 1932	Stocks at end of Oct., 1932*
Eastern Penn., N. J. & Md.	2,046,000	1,002,000	2,064,000	1,115,000	4,649,000	3,669,000	3,782,000
New York and Maine	686,000	328,000	661,000	364,000	1,185,000	1,278,000	1,314,000
Ohio, West'n Penn., W. Va.	769,000	757,000	581,000	417,000	3,310,000	2,691,000	2,352,000
Michigan	385,000	312,000	267,000	158,000	2,011,000	1,402,000	1,249,000
Wis., Ill., Ind. and Ky.	894,000	988,000	761,000	503,000	2,485,000	1,872,000	1,388,000
Va., Tenn., Ala., Ga., Fla., La.	733,000	680,000	763,000	518,000	1,656,000	1,440,000	1,278,000
East'n Mo., Ia., Minn., S.D.	827,000	894,000	474,000	379,000	2,710,000	2,029,000	1,513,000
West'n Mo., Nebraska, Kansas, Oklahoma and Arkansas	566,000	546,000	475,000	370,000	1,311,000	1,710,000	1,534,000
Texas	459,000	351,000	378,000	352,000	649,000	546,000	546,000
Colo., Mont., Utah, Wyo., Ida.	97,000	107,000	85,000	87,000	485,000	568,000	548,000
California	555,000	424,000	527,000	455,000	1,114,000	1,033,000	1,063,000
Oregon and Washington	144,000	73,000	120,000	64,000	654,000	526,000	517,000
	8,161,000	6,462,000	7,156,000	4,782,000	22,219,000	18,764,000	17,084,000

BY MONTHS	1931—Production	1932—Production	1931—Shipments	1932—Shipments	Stocks at end of month 1931	Stocks at end of month 1932
January	6,595,000	5,026,000	4,692,000	3,393,000	27,759,000	25,778,000
February	5,920,000	3,971,000	5,074,000	3,118,000	28,612,000	26,657,000
March	8,245,000	4,847,000	7,192,000	3,973,000	29,676,000	27,545,000
April	11,245,000	5,478,000	11,184,000	6,536,000	29,715,000	26,496,000
May	14,010,000	6,913,000	14,200,000	8,020,000	29,554,000	25,394,000
June	14,118,000	7,921,000	16,077,000	9,264,000	27,602,000	24,043,000
July	13,899,000	7,659,000	15,545,000	9,218,000	25,934,000	22,512,000
August	13,549,000	7,835,000	15,172,000	10,968,000	24,313,000	19,398,000
September	12,092,000	8,210,000	13,671,000	9,729,000	22,736,000	17,878,000
October	10,762,000	7,939,000	12,360,000	8,743,000	21,218,000	*17,084,000
November	8,161,000	6,462,000	7,156,000	4,782,000	22,219,000	18,764,000
December	5,974,000	.....	4,142,000	.....	24,098,000	.....
	124,570,000	.....	126,465,000	.....	.....	.....

PRODUCTION AND STOCKS OF CLINKER, BY MONTHS, IN 1931 AND 1932 (IN BARRELS)

Month	1931—Production	1932—Production	Stocks at end of month 1931	Stocks at end of month 1932
January	8,129,000	6,107,000	10,384,000	8,184,000
February	7,473,000	5,176,000	11,946,000	9,375,000
March	9,586,000	5,443,000	13,318,000	10,025,000
April	11,540,000	5,924,000	13,854,000	10,511,000
May	13,159,000	6,273,000	13,087,000	9,922,000
June	12,679,000	6,803,000	11,837,000	8,877,000
July	12,246,000	6,613,000	10,209,000	7,889,000
August	11,664,000	7,078,000	8,468,000	7,175,000
September	10,414,000	7,703,000	6,918,000	6,708,000
October	9,825,000	7,259,000	6,021,000	*6,093,000
November	8,259,000	6,290,000	6,215,000	5,937,000
December	6,840,000	.....	7,035,000	.....

*Revised.

†The value of imported cement represents the foreign market value at the time of exportation to the United States.

‡Includes 101 bbl. white nonstaining portland cement, valued at $345.

§White nonstaining portland cement.

¶Includes 620 bbl. white nonstaining portland cement, valued at $1253.

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN OCTOBER, 1932

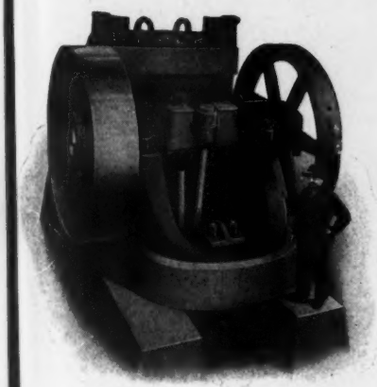
Exported to	Barrels	Value
Canada	395	$ 1,715
Central America	16,717	22,260
Cuba	132	617
Other West Indies	395	1,720
Mexico	1,130	3,520
South America	9,264	20,124
Other countries	723	2,966
	28,756	$52,922

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO IN OCTOBER, 1932

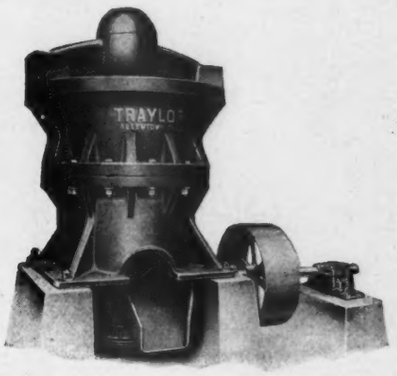
	Barrels	Value
Alaska	447	$ 1,202
Hawaii	25,503	57,816
Porto Rico	6,300	7,865
	32,250	$66,883

TRAYLOR EQUIPMENT CUTS COSTS

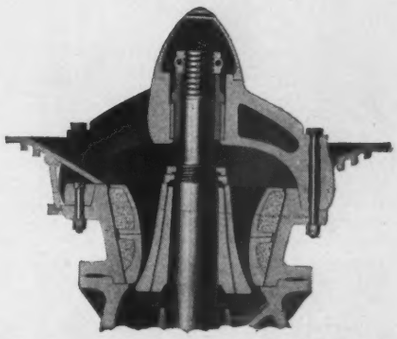
VISIT US AT NATIONAL CRUSHED STONE ASS'n EXPOSITION
BOOK-CADILLAC HOTEL
DETROIT, MICHIGAN
JANUARY 16-20, 1933
BOOTH NO. 20



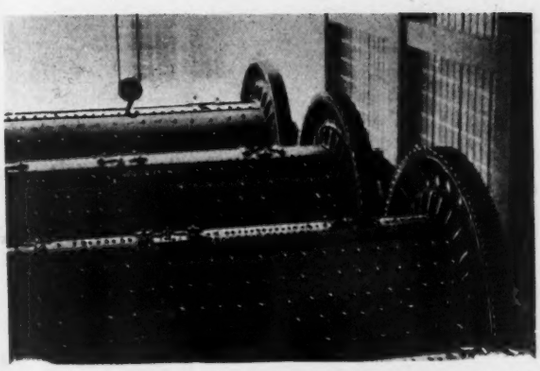
BULLDOG JAW CRUSHER



BULLDOG GYRATORY CRUSHER



TRAYLOR ORIGINAL NON-CHOKABLE BELL HEAD AND CONCAVES—APPLICABLE TO ANY TYPE OR MAKE OF GYRATORY



COMPARTMENT MILLS, ROTARY KILNS, COOLERS AND DRYERS

The name TRAYLOR takes on a new significance under the present day necessity for obtaining the maximum of production at the lowest possible cost.

With exceptional ruggedness as a safeguard against premature wear and costly shut downs plus a degree of efficiency that assures highest capacity without sacrificing quality, every product comprising the TRAYLOR line assures the utmost in dependable service and profits.

As an example: you can get 100 per cent more output from your old gyratory with the new patented TRAYLOR Bell Head and Concaves with the same power and obtain a finer product.

Decide now—to replace all obsolete, profit eating equipment with that backed by the TRAYLOR reputation for results and economy.

Write for Free Bulletins

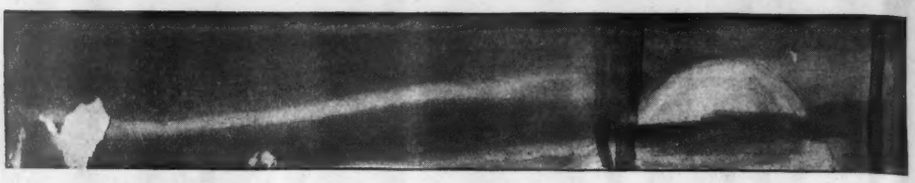
TRAYLOR ENGINEERING & MANUFACTURING CO.
ALLENTOWN, PENNSYLVANIA, U.S.A.

NEW YORK CITY 2513 Empire State Bldg. | CHICAGO 2131 One LaSalle St. Bldg. | LOS ANGELES 908-909 Chester Williams Bldg. | SEATTLE 815 Alaska Bldg. | SALT LAKE CITY 101 W. 2nd South St.

Timmins, Ontario, Canada—Moore Block

Export Department—104 Pearl St., New York City. Foreign Sales Agencies: London, Rangoon, Johannesburg, Lima, Sao Paulo, Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro

European Works—Usines Carels Freres, Ghent, Belgium



The Next 6

There is an engineer on the Link-Belt staff at your service. He is impartial, unbiased, competent, and ready to give you the full benefit of our technical experience. Send for him.

The Link-Belt shovel-crane-dragline is built for heavy-duty service in capacities from ¾ to 2½ yds.

LINK-BELT

HANDLING
WASHING

6 MONTHS?...

WHETHER the long and anxiously awaited turn is here or not, you and your company are at a crossroad. The next half year may present opportunities that can be grasped only if you can produce at lowest cost.

Is your plant prepared for business revival?

Prices are down. They will not return to boom levels suddenly. Profit margins will be small for some time. Business-hungry competitors will be quick to take advantage of any inability to meet their lower quotations.

Only modern methods and equipment can compete for the business on the horizon. This subject merits serious consideration. Why not get your rehabilitation plan under way?

Link-Belt can help you tremendously. Link-Belt handling, screening, washing, excavating and power transmission equipment is modern, is designed to eliminate losses and inefficiencies, and is well suited to modern production methods. It can be your answer to competition's challenge.

Think of the modern way to do it—and Link-Belt.

4646

LINK-BELT COMPANY

Leading Manufacturers of Equipment for Handling Materials Mechanically and Transmitting Power Positively

CHICAGO Works, 300 W. Pershing Rd. CHICAGO, Caldwell-Moore Plant, 2410 W. 18th St.
INDIANAPOLIS, Ewart Works, 220 S. Belmont Ave. INDIANAPOLIS, Dodge Works, 519 N. Holmes Ave.
PHILADELPHIA Works, 2045 W. Hunting Park Ave. SAN FRANCISCO Works, 400 Paul Ave.
Link-Belt Limited—Toronto Works, Eastern Ave. & Leslie St.; Montreal, 934 Inspector St.; Vancouver, 550 Beatty St.

Offices in all Principal Cities

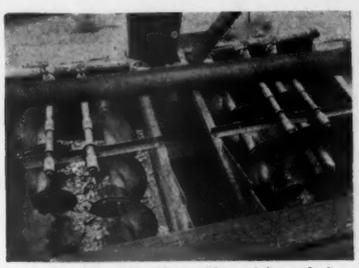
LINK-BELT PREPARATION EQUIPMENT

A complete Link-Belt sand and gravel washing plant

The Link-Belt Vibrating Screen. A triumph of mechanical vibration

Link-Belt manufactures every type of conveying equipment, such as belt, apron, bucket, screw, flight, etc.

Link-Belt screens include: inclined conical, vibrating, rotary disc grizzlies, bar, rotary—all types, for every service

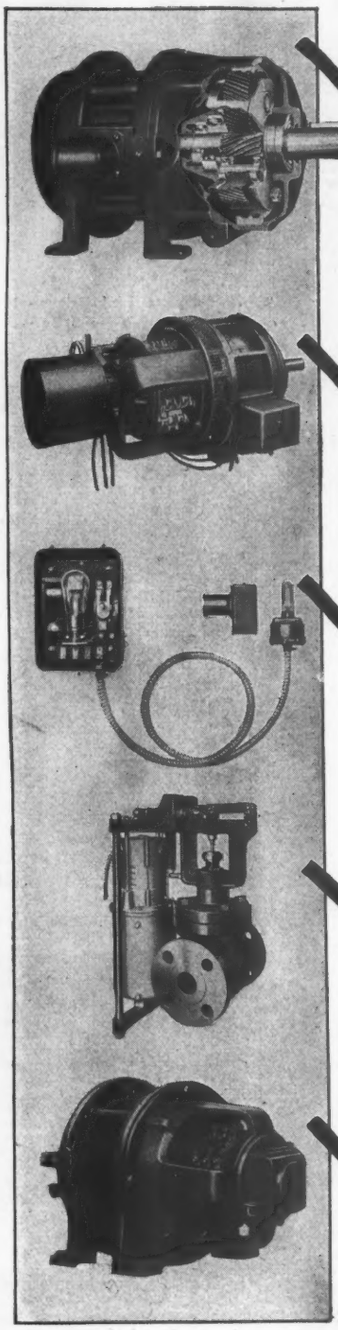


A complete line of washing units, of the log, screw, flight and screen types

Elevators of all types and capacities, portable loaders, skip hoists, etc.

Check

these G-E Money-Saving Equipments



GEAR-MOTOR — a G-E motor with a built-in speed reducer combined into a compact, efficient, and economical unit ready for direct connection to your machine. It will provide the desired speed at the output shaft. These units are available for use on any standard a-c. or d-c. power supply. Wherever you need a dependable low-speed drive that is low in maintenance and high in efficiency, specify G-E Gear-motors.

BTA MOTORS — the most efficient, adjustable-speed, a-c. motors ever built. They offer you the desirable characteristics of shunt-wound d-c. motors, without conversion equipment. They will provide accurate speed control for your rotary kilns, conveyors, fans, feeders, etc. Let these dependable drives help you in lowering your 1933 operating costs.

PHOTOELECTRIC CONTROL — the electric eye that, by a beam of light, can be used to control accurately such operations as weighing, counting, sorting, lighting, etc., without human or mechanical errors. For example: this equipment is now used to proportion, automatically, cement and aggregate in ready-mixed-concrete plants. You have many applications for this labor-saving device. Don't fail to check it.

THRUSTOR VALVES — superior valves operated by G-E Thrustors — those self-contained, motor-operated, hydraulic cylinders that produce a smooth, straight-line, constant pressure thrust. Advantages: remote control, smooth action, no water hammer, few wearing parts. Consider these valves for handling your slurry, water, oil, etc. They will save you time and money.

POWER SELSYN DEVICES — provide a positive, accurate method of synchronizing two or more drives, such as a machine with its feeder, or a number of conveyors, or related drives in general. If you want to improve the quality of your product, it will pay you to investigate G-E power Selsyn devices for synchronizing your slurry-feeder with the kiln.

If you would like additional information on any of these G-E money-saving equipments, address your nearest G-E office or General Electric Company, Schenectady, N. Y.

200-672

GENERAL ELECTRIC

Haynes Stellite *a money-saver*

on Equipment EXPOSED TO ABRASIVE WEAR

On conveyor screws or other machine parts that abrasion attacks, a facing of Haynes Stellite means longer service and smoother performance. This red-hard alloy is easily and economically applied with the oxy-acetylene blowpipe.

Haynes Stellite saves thousands of dollars annually for cement and rock products plants by multiplying the life of equipment exposed to heat or abrasion. The following examples are typical:

An Eastern cement plant Haynes Stellites *tube mill bushings* and lengthens their life from 3 months to 3 years.

By Haynes Stelliting its *carbon steel drill bits,* a Minnesota iron mine increases their life from 300 ft. to 2,381 ft.

By applying Haynes Stellite to *dredge cutter blades,* a California company digs 92,000 cu. yds. as compared to 42,000 cu. yds. with blades surfaced with another hard-facing material.

Haynes Stellite engineers can show you how to benefit from the unusual properties of this metal by helping you determine its applications in your plant. This service is yours for the asking—and is furnished with no thought of obligating you. Write today for complete information.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

Chicago • Cleveland • Detroit • Houston • Los Angeles • New York • San Francisco • Tulsa

General Office and Works—Kokomo, Indiana

Foreign Sales Department—New York City

Haynes Stellite Welding Rods and information on other Haynes Stellite Products also are available through the 42 apparatus shipping points of The Linde Air Products Company

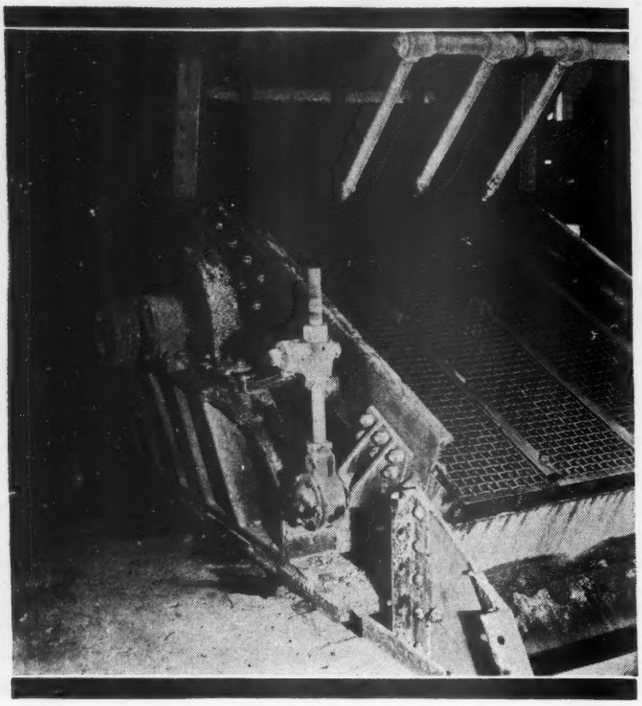
HAYNES STELLITE TRADE MARK

A red-hard, wear-resisting alloy of Cobalt, Chromium and Tungsten

THE SKF GALLERY OF DISTINGUISHED PERFORMANCE USERS:

HURON INDUSTRIES, INC.

BRUTE JOBS PROVE ECONOMY OF SKF BEARINGS



150 TONS AN HOUR ... continuously ... is the capacity of this 4' x 8' Huron Heaviduty Screen in a large crushed stone plant. Here's a brute job that calls for brute bearings. Absolute dependability is demanded. And to meet these exacting requirements, Huron uses two SKF Spherical Roller Bearings for the eccentric, two in the outboard bearing location and four SKF Self-Aligning Ball Bearings for the corner brackets.

SKF Ball and Roller Bearings have a long record of successful performance in the rock products industry on many types of heavy duty equipment. They are rugged and strong for tough work yet run smoothly with a minimum of friction. Throughout a hard and long life marked by very little attention they show no wear and never require adjustments. That is why SKF Performance Takes Preference Over Price with Huron and leading manufacturers in this field.

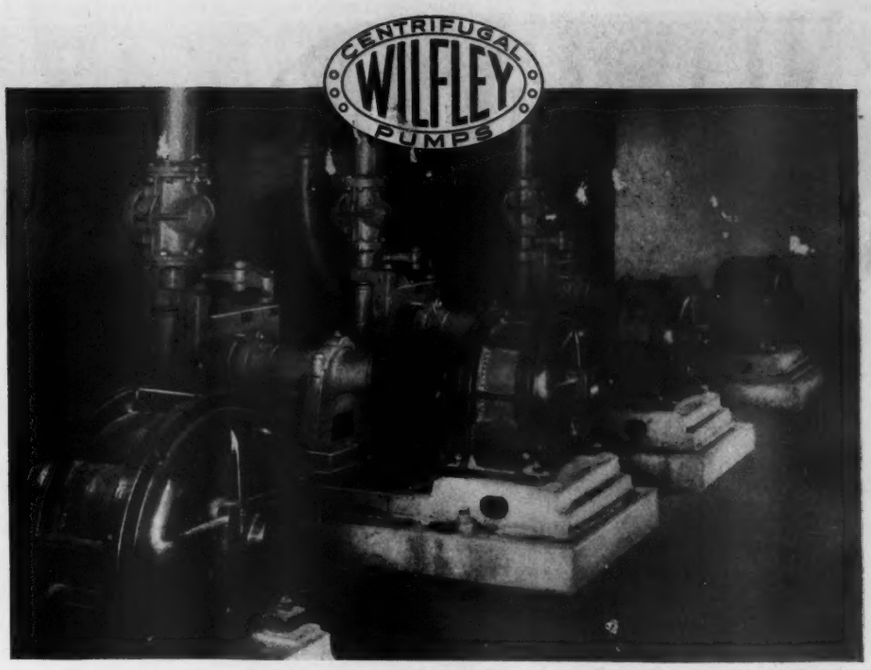
SKF INDUSTRIES, Inc.
40 East 34th Street, New York, N. Y.

2970

WHERE PERFORMANCE TAKES PREFERENCE OVER PRICE

● *You may buy a bearing as a bargain but try and get a bargain out of using it, for nothing is apt to cost so much as a bearing that cost so little.*

SKF
BALL AND ROLLER BEARINGS



Use WILFLEY Slurry Pumps

...to help bring down mill costs!

IT was not without reason that so many wet process plants, when changing over or building anew, selected the Wilfley Centrifugal Pump for handling the slurry. ¶ The "non-stuffing box" feature of this pump attracted their interest. A study of the details gave them a new visualization of what could be done in the way of getting low mill costs insofar as the handling of the slurry was concerned. ¶ The Wilfley Pump showed them a way to handle slurry effectively, regardless of moisture content, at low cost. ¶ A majority of wet process plants in this country are now fully equipped with Wilfley Slurry Pumps.

A. R. WILFLEY AND SONS, INC.
Denver, Colorado, U. S. A.

AGENTS

Canada—
The Mine & Smelter Supply Co., c/o Wm. Hamilton, Ltd. Peterborough, Ontario Licensees and Manufacturers

Australia—
The Mine & Smelter Supply Co., c/o F. H. Jackson, 67 York St., Sydney, Licensees and Manufacturers

South Africa—
Edw. L. Bateman (Pty), Ltd., Locarno House, Johannesburg, Licensee and Manufacturer

WILFLEY
centrifugal SAND PUMPS
PATENTED

And Now Another Advance In Finer Reduction Crushing

This new crusher was developed for those confronted with the problem of finer crushing. With the growing demand for minus ½ inch materials for surfacing black-top and similarly surfaced roads and for even crushing to finer sizes, it is now possible with the new Symons Short Head Cone Fine Reduction Crusher to produce these materials and still maintain plant capacity. In order to secure these finer products in quantity and in the sizes wanted, it is not necessary to produce those for which there is little or no market. Stock piling and rehandling are eliminated. Crushing costs are lowered, profits are increased.

For extremely fine crushing, the performance of the Short Head is as much of an advance over the Standard Cone as this was over the other types of crushers which it replaced.

If your operations are hampered with the demand for finer products, let us show you what the new crusher will do. Our Representative at the Stone and Gravel Show will gladly explain its possibilities.

NORDBERG MFG. CO., MILWAUKEE, WIS.

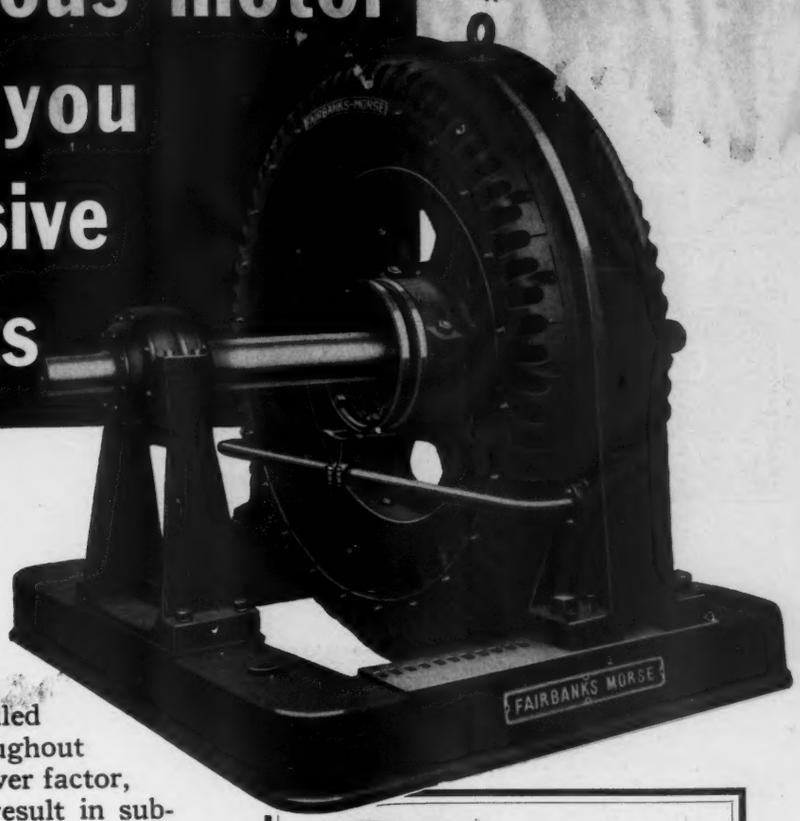
NEW YORK
60 East 42nd St.

LONDON, WC2 ENG.
Bush House

LOS ANGELES
Subway Terminal Bldg.

SYMONS CONE CRUSHERS

A synchronous motor can FREE you from excessive penalty costs



F-M Pedestal-Type Synchronous Motor with Double-Row Spherical Bearings. Engine types and high-speed bracket types also available

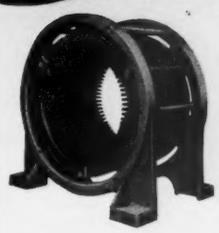
MANY users of electric power are finding that synchronous motors installed at advantageous points throughout their plants improve plant power factor, eliminate penalty costs and result in substantial savings.

Modern synchronous motors cover a wide range of drive requirements from extremely large, low-speed machines to smaller high-speed types for constant speed drives, and where squirrel-cage motor characteristics are suitable.

Fairbanks-Morse offers you the synchronous motor at its best—in a complete range of sizes from 20 to 10,000 horsepower. In these machines are incorporated all the refinements contributing to electrical efficiency plus an unequaled mechanical efficiency—which means overall economy on the drive.

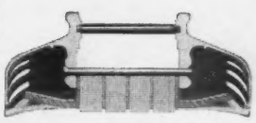
In the panel at the right are shown a few of the mechanical features which indicate the improvement of Fairbanks-Morse Synchronous Motors over conventional construction.

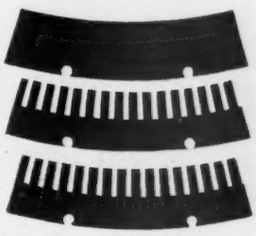
The complete description will be sent on request by addressing the nearest F-M Branch or Fairbanks, Morse & Co., 900 S. Wabash Avenue, Chicago.



Nutless, boltless and threadless stator core assembled and ready to receive coils. Welding the core as a unit removes chances of laminations loosening

Stator core laminations blanking out and after the winding slots have been punched. Ventilator plate at bottom shows how adequate tooth support and maximum strength are obtained without obstructing air passages





Section through core and frame ends showing the reaction pins and manner in which stacking pins are welded to form a permanently tight stator core

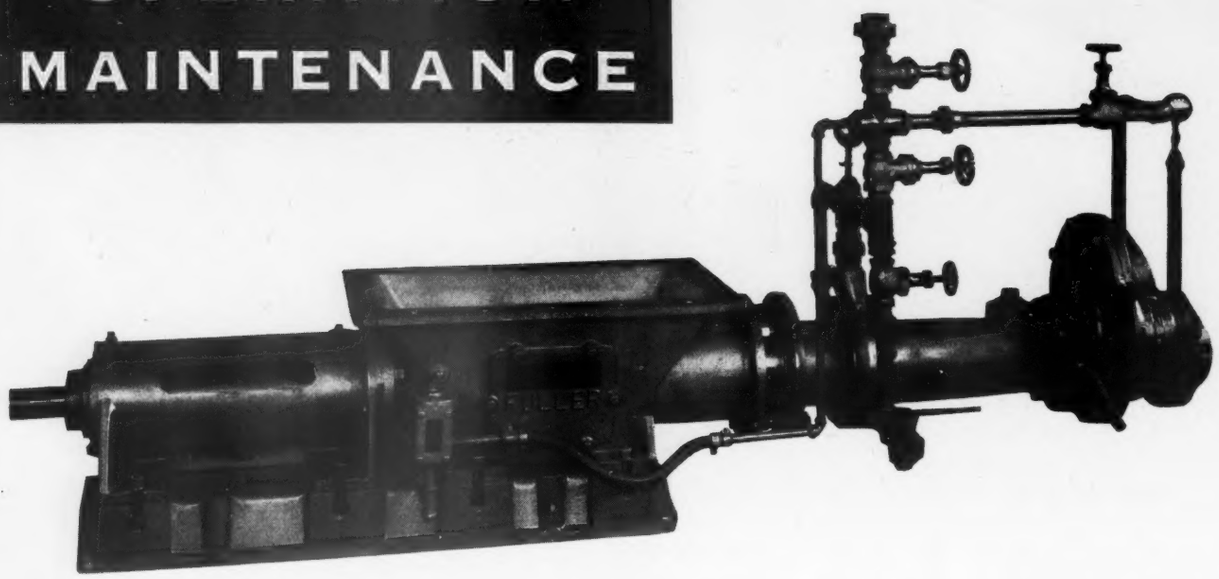
FAIRBANKS-MORSE MOTORS

5816-EA97.31

POWER PUMPING AND WEIGHING EQUIPMENT

THE NEW TYPE "F" FULLER-KINYON PUMP CUTS ALL COSTS IN CONVEYING DRY PULVERIZED MATERIALS

—POWER—
INSTALLATION
OPERATION
MAINTENANCE



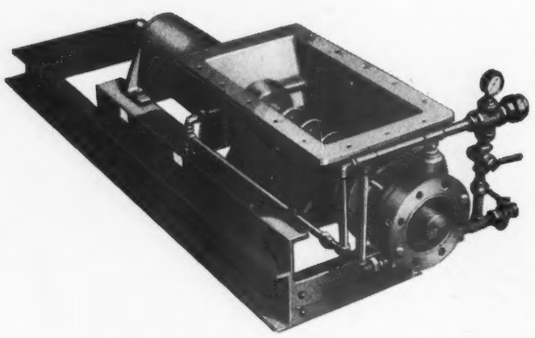
This radical improvement offers you tangible economies under every cost consideration. New mechanical advantages have been provided and no operating or layout features of earlier types of Fuller-Kinyon Systems have been sacrificed.

Our claims for these new pumps are established by their excellent records of service during the past year. They have been successfully used under all conveying conditions.

Power reduction is the outstanding advantage, but new mechanical simplicity and accessibility of all parts increase reliability and make operation more convenient.

These features make it an ideal replacement for worn or obsolete mechanical conveyors.

Present users of older types of pumps can obtain the same power advantage and reduced maintenance cost with a slight change in their present pumps, at negligible cost. Write for full information.



The air ring and barrel bushing are adjustable with relation to the screw, to change the seal while the pump is in operation. The base shown is furnished for the motor or gas engine, when the pump is used for unloading Hopper-Bottom Cars.

Fuller Company
CATASAUQUA, PENNA., U. S. A.

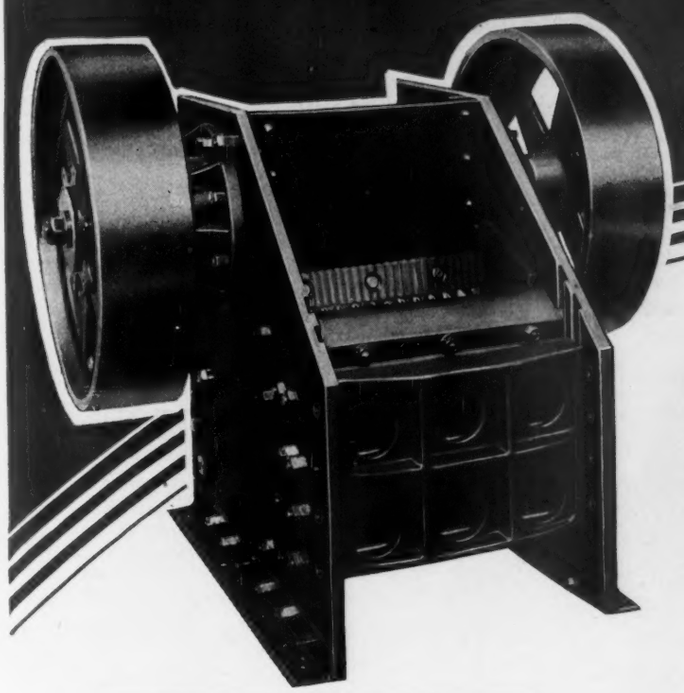
CEMENT WEIGHING BATCHERS
PNEUMATIC CONVEYORS
COMPRESSORS

STATIONARY and PORTABLE **FULLER-KINYON** ***CONVEYING SYSTEMS***

Replace Obsolete Equipment With

Good Roads MACHINERY

New!



Cut shows adjustable feature of Stationary Jaw. As shown—Set in position for secondary crushing.

One Crusher Replaces Two!

The Good Roads Champion Roller Bearing Crusher is now offered with adjustable feed opening to accommodate either primary or secondary crushing.

The 2 in 1 crusher of the 10″ x 30″ size can be adjusted to give a 15″ x 30″ opening for primary crushing and the 10″ x 40″ size can be adjusted to give a 15″ x 40″ opening.

This flexibility heretofore unknown in a Rock Crusher will save you real money.

You can't meet today's competition with inefficient, obsolete equipment—curtailing production and eating into your profits.

Good Roads Champion Roller Bearing Crushers, with their large jaw openings plus long crushing dies accomplish the dual purpose of primary and secondary crushing with unusually large capacity —low operating cost and low cost per ton.

Other GOOD ROADS Products

Quarry Machinery:

Bucket Elevators and Conveyors
Vibrating and Revolving Screens
Sand Wash Boxes
Feeders—Apron and Reciprocating
Scrubbers
Grizzlies

Road Machinery

Graders
Snow Plows
Oil Distributors
Spreaders, Chip and Sand
Road Drags

Call at Exhibit Space No. 307
Road Show at Detroit, Jan. 16-20

GOOD ROADS MACHINERY CORP.

KENNETT SQUARE, PA.

Uniform Hardness is a Most Essential Characteristic in Grinding Balls

AS the big fish eat up the little ones, if both are kept in the same pool, so grinding balls of unequal hardness are undesirable in the same mill. The harder balls will grind up the softer ones.

When this happens, not only are the softer balls destroyed but the harder ones work to a much lesser purpose than is expected or required of them.

Uniform hardness is assured when you specify Lorain Grinding Balls. The high carbon steel of which they are made is not only rolled in definite accordance with A. S. T. M. specifications as to analysis and quality, but it is double-tested as to specifications. Tests for Brinnel hardness and toughness are continuous in our manufacturing processes and are unvarying at all times. Satisfactory and unfailing production in your mills is the result.

The Lorain Steel Company

General Offices: 545 Central Avenue, Johnstown, Pa.

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

Sales Offices: Atlanta Chicago Cleveland Dallas New York Philadelphia Pittsburgh

Pacific Coast Distributors: Columbia Steel Company, Russ Bldg., San Francisco, Calif.

Export Distributor: United States Steel Products Company, 30 Church St., New York City, N. Y.

All sizes of balls common to cement and ore grinding, stocked at Johnstown, Pa., in car loads for immediate shipment and at Denver, Colo., for less carload shipments:

¾" ⅞" 1" 1¼" 1½"
1¾" 2" 2½" 3"
3½" 4" 4½" 5"

Insist on UPKEEP ECONOMY

...fewer delays
...quick, easy repairs
...permanent service

UPKEEP ECONOMY is difficult to measure in dollars and cents. In your "maintenance costs" an item of only a few dollars may actually represent a loss of several hundred dollars due to delay, lost output, wasted pay roll, and breaking down of smoothly working schedules.

Upkeep economy (best measured in "total maintenance cost" divided by "output") is a vital factor to consider when you select your excavating equipment. To secure upkeep economy you look for balance in strength, simplicity of construction, ample power properly applied, a minimum of moving parts, insurance of permanent alignment, ready accessibility, adequate, convenient lubrication and protection against abrasive dirt.

Bucyrus-Erie gives a maximum of balanced value in all these features. Possibilities of breakdowns are reduced to a minimum. When repairs are necessary they can be quickly made, repair parts are reasonably priced, repair service is prompt and its permanence assured. 572

BUCYRUS-ERIE COMPANY, South Milwaukee, Wis.

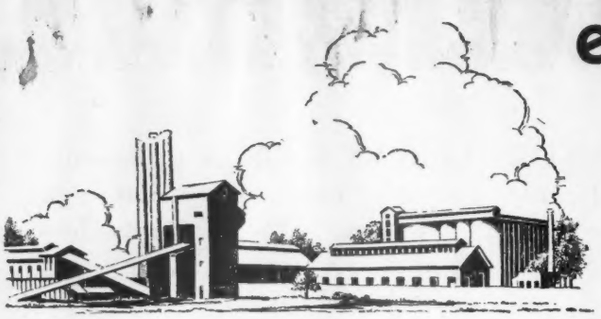
Do not purchase any machine — new or used — without careful study on *all* counts. Measure dependability, power, speed, operating efficiency and upkeep economy; weigh the reputation, experience and resources of the manufacturer.

BUCYRUS ERIE

SEE BUCYRUS-ERIE BEFORE YOU BUY!

MOST FOR YOUR MONEY

$110 to $165 can be saved each working day in raw-material grinding alone



EVERY day that an average-size dry-process cement plant operates with the new system of raw-material grinding developed by The Babcock & Wilcox Company, $110 to $165 can be saved. This estimated saving is based on a plant capacity of 5,500 barrels per day, electrical energy at a cost of 1¢ per kilowatt-hour, and performance data on this system in regular cement-plant operation.

Even if this typical plant operated only 100 days each year the resultant saving of $11,000 to $16,500 would be sufficient to warrant a thorough investigation of this system. That is one reason why aggressive cement company executives throughout the country are taking advantage of The Babcock & Wilcox Company's offer to submit a complete analysis of the saving that can be made in any dry-process plant.

The Babcock & Wilcox Company

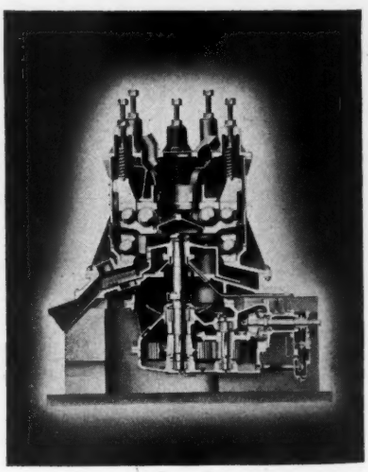
85 Liberty Street . . . New York . . . N. Y.

BABCOCK & WILCOX

No other pulverizer has all these features

1. Extremely low power consumption.
2. Dependable fineness.
3. Efficient grinding elements, not affected by wear.
4. Minimum floor space.
5. Dustless and quiet operation.
6. No lubrication in grinding zone.
7. Few wearing parts — all easily accessible for quick replacement.

In this new method of raw-material grinding, a Babcock & Wilcox Type B Pulverizer operates in closed circuit with a mechanical classifier, and reduces cement rock in a single operation from hammer-mill product of 1½ inches and under to such a fineness that it may be delivered directly to the kiln. The material passes through the pulverizer rapidly and in a thin stream, and the grinding pressure is applied directly to the material . . . therefore the pulverizer has a high capacity and a high efficiency. The total power consumption for raw-material grinding is practically half that required by the usual equipment.



F-269

Single reversible Aerial Wire Rope Tramway — capacity of 75 tons an hour—440 ft. long—for storing Sand and Gravel. This cut shows the superior construction of our Locked-Coil Track Cable.
The TIGER TRADE MARK is a symbol of Strength and Dependability
THE MARK FOR GENUINE AMERICAN WIRE ROPE

AMERICAN
STEEL & WIRE COMPANY
AERIAL TRAMWAYS
BLEICHERT SYSTEM

For Storing Sand—Gravel—Stone

To any height—Over any area—At any point
With no structures in the piles
All material reclaimable
In Summer and Winter
With low operating cost
With low maintenance cost
Dependability with long life—in fact
The only way you should store

SAND—GRAVEL—STONE

Estimates of cost submitted gladly. Write us.

1831 MORE THAN 100 YEARS of PROGRESS IN WIRE MAKING **1932**

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

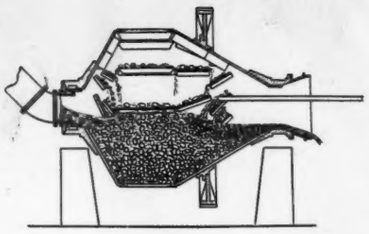
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Bldg., New York
First National Bank Bldg., Baltimore

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco
Export Distributors: United States Steel Products Company, New York

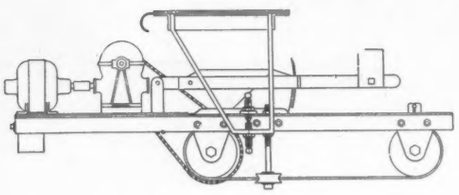
Hardinge Equipment

Hardinge Conical Scrubber



For washing Stone, Sand and Gravel. Several large Hardinge Scrubbers installed to replace unsatisfactory equipment have been operating for months, delivering a clean product which fully meets standard specifications. This Scrubber is essentially a large conical drum rotated on trunnion bearings, with no internal moving parts, submerged bearings or packing glands to maintain. Upkeep is practically negligible. Operating costs very low. Write for information.

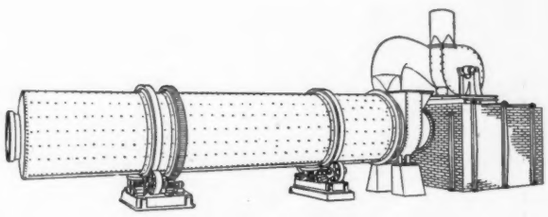
Hardinge Constant Weight Feeder

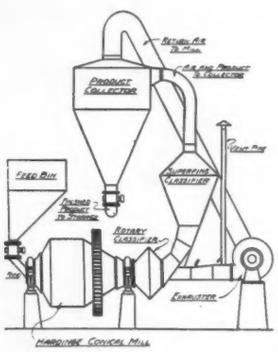


A continuous Feeder measuring by weight instead of volume. It varies not more than 1% in accuracy and occupies less than half the space of any other weighing device. When more than one Feeder is used to feed and proportion in one operation, accurate ratios are maintained and precise specifications met without difficulty. Write for Bulletin No. 33A.

Ruggles-Coles Dryers

Drying by direct or indirect heat. The outstanding "economy" feature of the indirect heat dryer is its method of discharging the product. The dried material is delivered outside the furnace, not through it, thus increasing furnace efficiency and preventing the shell from being burned out. The Class "XA" Dryer utilizes a combination of direct and indirect heat, and has the highest thermal efficiency of any rotary dryer made. In the fully indirect heat type, an exceptionally large heating surface is provided without putting undue strain upon the shell. The material is completely protected from the gases of combustion, and temperatures are under perfect control.





HARDINGE CONICAL MILL

Hardinge Conical Mill

Grinding Limestone and Clinker with air classification. Recent tests conducted over long periods of time have been so successful that a 10-ft. Conical Ball Mill has been ordered to handle increased capacity in a western cement plant. The cost of grinding by this method is considerably less than by the standard methods using regulation tube mills. Write for information.

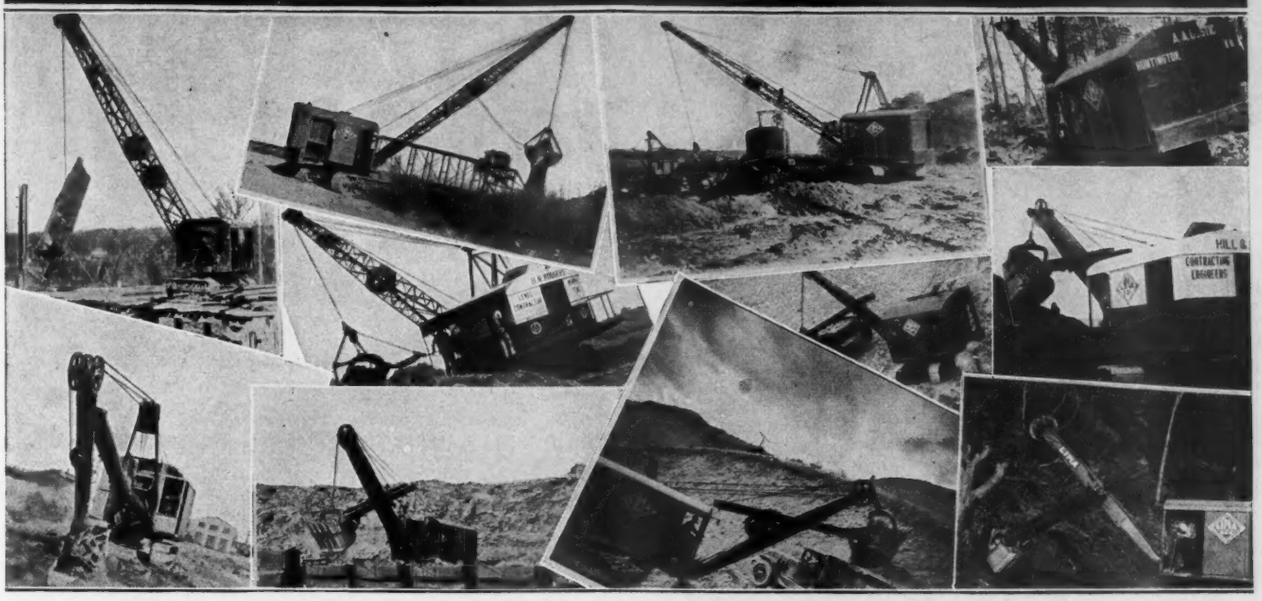
Hardinge Company, Inc., York, Pa.

New York — 122 East 42nd Street
Chicago — 205 W. Wacker Drive
San Francisco—235 Montgomery St.

Hardinge

Conical Ball, Pebble and Rod Mills, Ruggles-Coles Dryers, Feeders, Rotary Conveyors, Stone Screens, Thickeners, Clarifiers

A LIMA TO FIT YOUR REQUIREMENTS



3-4 YD. - 1 YD. - 1 1-4 YD. - 1 1-2 YD. DIPPER

SHOVELS - CRANES - DRAGLINES - BACKDIGGERS

GASOLINE - DIESEL - ELECTRIC POWER

INSIDE OR OUTSIDE DIPPER HANDLE

CHAIN OR CABLE CROWD

LIMA'S complete line of shovels, cranes, draglines and backdiggers offers a size and type to exactly fit your requirements. They are built in sizes from ¾ cubic yard to 1½ cubic yard capacities, with a choice of gasoline, Diesel or electric power, chain or cable crowd, and inside or outside dipper handle.

Many advanced and exclusive features are incorporated in their design, features which assure faster and more economical operation.

Write for bulletin today.

THE OHIO POWER SHOVEL CO.

DIVISION LIMA LOCOMOTIVE WORKS INCORPORATED

HOME OFFICE LIMA, OHIO, U. S. A. FACTORY

SEATTLE 2244 First Ave. So.

CHICAGO, ILL. 2026 Straus Bldg.

NEWARK, N. J. 317 Frelinghuysen Ave.

DALLAS 1303 So. Lamar St.

The General Supply Co. of Canada, Ltd. Ottawa, Ont

MEMPHIS 1201 Cotton Exchange Bldg.

Tyee Machinery Company, Ltd. Vancouver, B. C

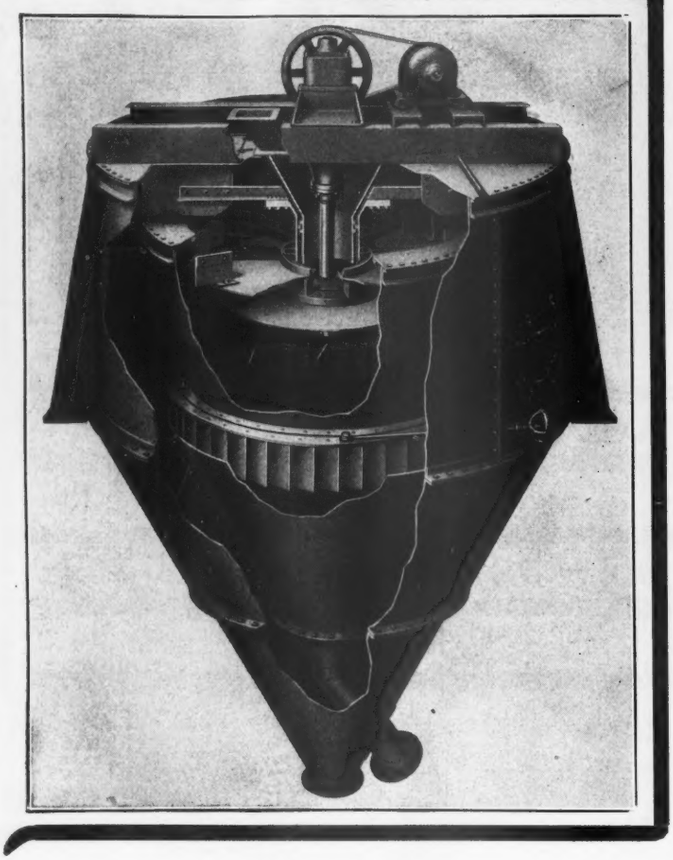
EXCLUSIVE WITH LIMA

EVERY LIMA IS EQUIPPED THROUGHOUT WITH ROLLER BEARINGS

LIMA

LIMA 101·302·404 502 and 601

The NEW STURTEVANT Air Separator



Embodies

3 YEARS INTENSIVE AERODYNAMIC STUDY

devoted especially to disproving, as well as proving, certain existing theories regarding separation by air,

14 YEARS EXPERIENCE IN BUILDING, ***and***

50 YEARS EXPERIENCE IN SEPARATION

We have tried the principles of all competing makes, recorded and compared the results with those of our own machines under identical circumstances. New and old theories were tested and developed establishing an entirely new Air Separator technique. Every "gadget," every known method, every suggestion of merit was thoroughly tried out. Many features of accepted practice could not stand the test and were discarded, and conversely, many heretofore new and untried theories proved revolutionary. The result of this experienced research is our New Separator.

It Separates Dry Materials from 50 to 350 Mesh

Ask us what this separator will do for you.

Ask us what you may expect in the way of an improved product—a dependable product—a product of unvarying fineness. Ask us how it will increase your pulverizer capacities.

To answer these questions we will want to know: Material to be separated. Fineness of wanted product. Percentage of this fineness in the feed to separator. Tonnage wanted in finished product. Kind and size of pulverizer to be used with separator.

STURTEVANT MILL CO. HARRISON SQUARE **BOSTON, MASS.**

THE efficient, silent, self-contained DE LAVAL WORM REDUCTION GEAR is, like the electric motor which it serves, the result of specialized, large scale production on a precision basis. Its scientific design and high grade construction adapt it for continuous, heavy service. It requires no attention further than to supply oil at long intervals.

De Laval Steam Turbine Co., *Trenton, N.J.*

SAVES LABOR

SAVES FUEL

SAVES FILTER CLOTH

REDUCES KILN LOSSES

LOWERS UPKEEP COST

EARNS ITS' COST

SUPPORTED BY COST REDUCTION FEATURES

YOU cannot afford to let obsolete methods eat into your profits when the FEinc Continuous Filtering and Drying System—the most economical system devised for dewatering cement slurry, produces driest cake with minimum repairs, power consumption and operating cost as proven by actual data gathered under varied operating conditions in European installations. It is the only continuous filtering and drying system that will handle thin cakes.

The FEinc Continuous Filter and Dryer makes the kilns of a wet process mill operate as a dry plant because it feeds dry slurry to the kiln.

In short—it is the system that will pay for itself in the shortest time.

FILTRATION ENGINEERS INCORPORATED

SERVICE FE ECONOMY

ARTHUR WRIGHT & ASSOCIATES

General Sales Representatives

155 East 44th St., New York City

1580 Macadam Road
Portland, Ore.

Northern Foundry & Machinery Co.
Sault Ste Marie, Ont.

Watt Machinery & Equipment Co.
Montreal

TO BETTER MEET 1933'S CHALLENGE

FOR LOWER OPERATING COSTS

P&H WILL SOON PRESENT AN

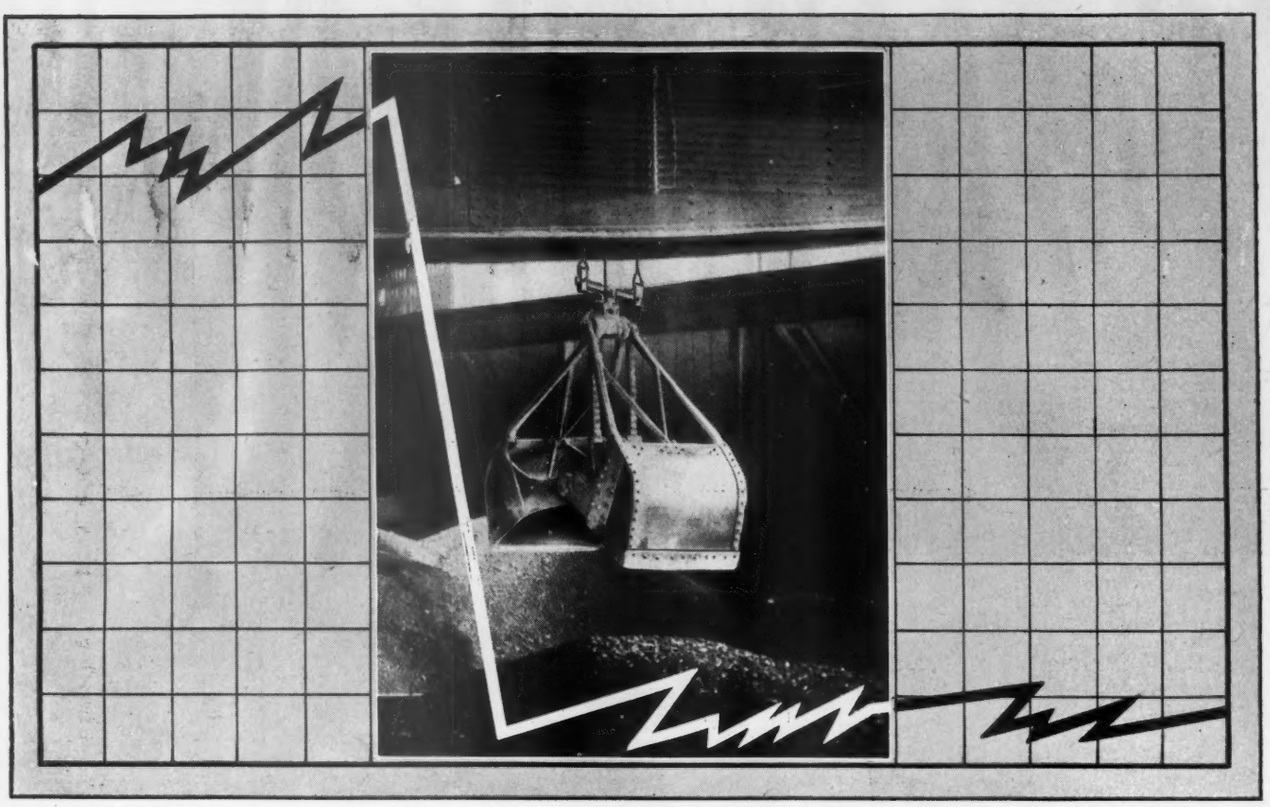
IMPROVED LINE OF EXCAVATORS WITH

for a bigger day's work

HARNISCHFEGER CORPORATION

4404 West National Avenue • Established 1884 • Milwaukee, Wisconsin

Warehouses and Service Stations: Hoboken Memphis Jacksonville Seattle Los Angeles San Francisco Dallas



Lowest Cost Handling

. . . the only thing that counts in 1933!

Hayward Buckets enable the shrewd user to cash in on this situation in two ways. New prices make Haywards the most attractive buy in decades. Further, new improvements in bucket construction provide major operating economies that definitely contribute to profits on every job.

Added to all this, Hayward Buckets give you these three extra advantages:

1. The right bucket for the job. Hayward makes all four types,—clam shell, drag line, electric motor, and orange peel. *Hayward can afford to be unbiased in serving your needs.*

2. A bucket that won't quit—that won't cause time out.

3. A bucket that is good for years of hard service. An investment, not a gamble.

Get catalogs, details, and prices. Here's an opportunity you will want to know about now.

THE HAYWARD COMPANY, 200-204 Fulton St., New York, N. Y

Cleveland Chicago San Francisco

Electric Motor
Orange Peel

HAYWARD BUCKETS
BUILT FOR ALL THE WORLD
TRADE HAYCO MARK

Clam Shell
Drag Line

Hayward Buckets

FOR THOSE WHO UNDERSTAND WIRE ROPE CARE

WILLIAMSPORT WIRE ROPE

Williamsport Wire Rope has the stamina to undergo severe stress and with proper care will generally render an unusual service — noticeably longer and noticeably more satisfactory.

No other rope, regardless of construction or price, is or can be made uniformly better. If you pay more money for any wire rope than Williamsport asks—you're just wasting money and we can prove it. Remember this—whenever a wire breaks in a cable the factor of safety reduces just that much and a broken wire on a peppy Williamsport Cable is instantly noticeable—a mighty good warning sign to have!

Write us for further comparative facts.

WILLIAMSPORT WIRE ROPE COMPANY

Main Office and Works:
WILLIAMSPORT, PENNA.

General Sales Offices:
122 So. Michigan Ave., CHICAGO

APEX . . THE NEW QUARRY EXPLOSIVE

IN DRILLING COSTS

GAINED 38½%

GREATER TONNAGE BLASTED PER POUND OF EXPLOSIVE

That's the report of a shot made, August 19th, 1932, where 21,000 tons of rock were blasted with the use of 4612½ pounds of Apex.

The tons of rock blasted per pound of explosive were estimated at 4.53, whereas the average for the year previous when other explosives were used was 3.6 tons. The burden and spacing was 15 x 15, whereas the spacing and burden for gelatin was 12 x 12. The loading time was from 9 A. M. to 4:30 P. M., and the shot was fired at 4:45 P. M. with 45 well drill holes.

Apex—the new Atlas Quarry Explosive—will help you cut *your* costs right now! Apex' blasting action stays with the burden and gets a real purchase on the material. This has unquestioned advantages on a *dollar and cents basis.*

ATLAS POWDER COMPANY

A proper explosive for every blasting requirement

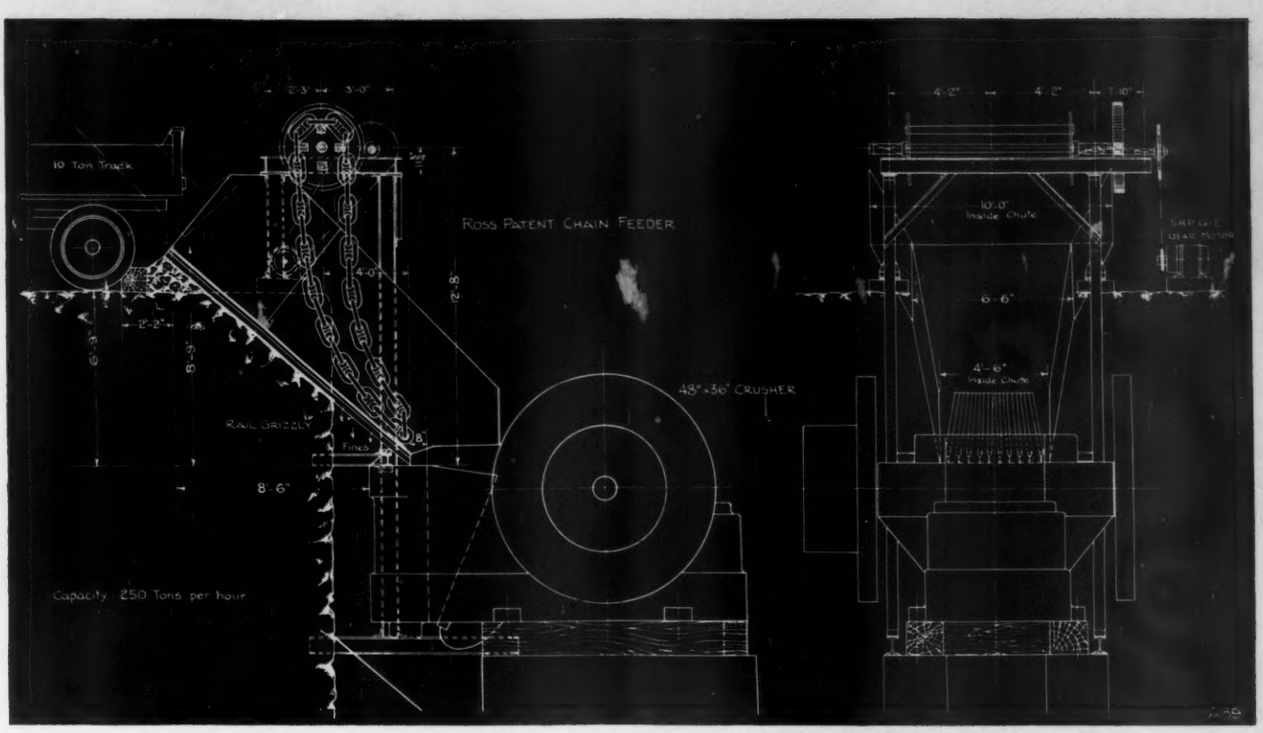
WILMINGTON, DELAWARE

ATLAS EXPLOSIVES

ATLAS EXPLOSIVES

BRANCH OFFICES:

Allentown, Pa.; Boston, Mass.; Charleston, W. Va.; Denver, Colo.; Houghton, Mich.; Joplin, Mo.; Kansas City, Mo.; Knoxville, Tenn.; Memphis, Tenn.; New Orleans, La.; New York, N. Y.; Norristown, Pa.; Philadelphia, Pa.; Pittsburg, Kans.; Pittsburgh, Pa.; Pottsville, Pa.; St. Louis, Mo.; Tamaqua, Pa.; Wilkes-Barre, Pa.



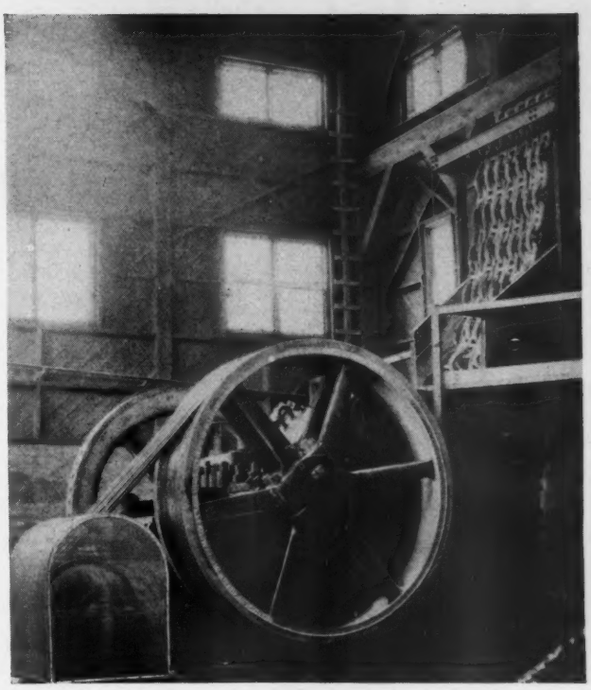
Right at the first unit and at intermediate points in the plant, such as surge bin outlets and conveyor feeds, the ROSS FEEDER provides a modern, highly efficient method of handling all granular material.

Flow control insures increased production and greatly reduces maintenance and operating costs.

●

We shall be glad to submit recommendations on your feeding problems, without obligation.

The ROSS FEEDER is patented in all the principal countries of the world.



Ross Feeder feeding 60" x 48" Crusher from Silo Storage

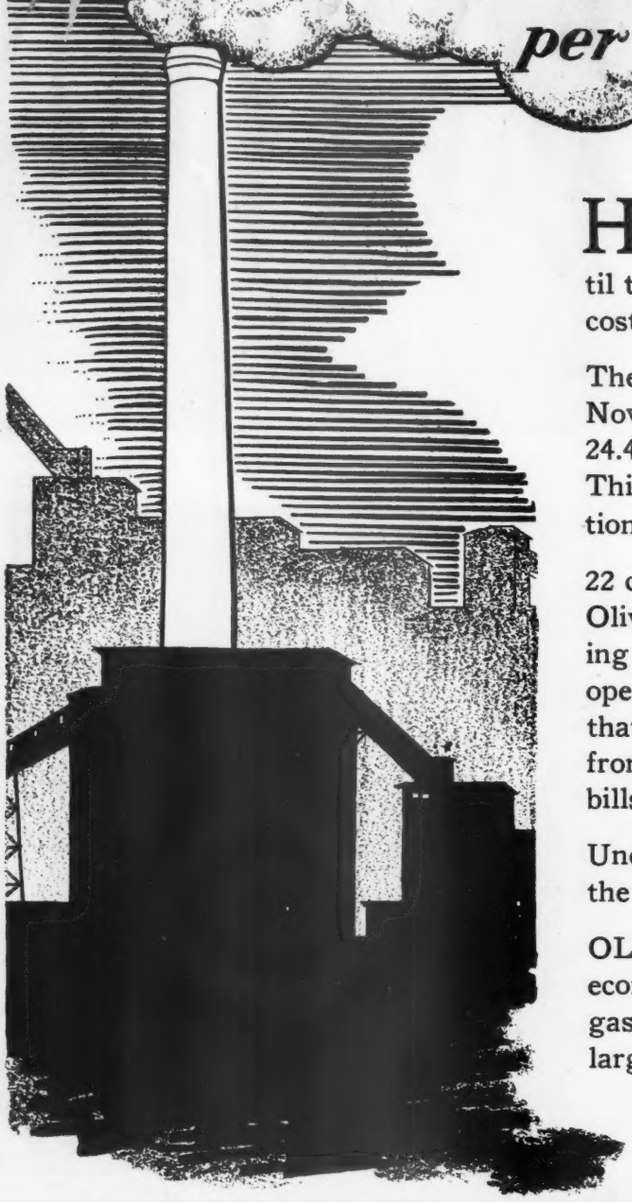
ROSS SCREEN & FEEDER COMPANY

247 PARK AVENUE
NEW YORK, U. S. A.

2 VICTORIA STREET
LONDON, S.W.1, ENGLAND

SAVE THOSE PRECIOUS B.T.U.'s

- and save 4¢ to 6¢ per barrel of cement



HEAT losses, measured in evasive B.T.U.'s, have an uncanny way of escaping notice until they loom up as giants when transformed into cost figures.

The U. S. Tariff Commission's report issued in November, 1931, shows that fuel charges make up 24.4% of the production cost of a barrel of cement. This cost can be cut considerably by the installation of OLIVER UNITED SLURRY FILTERS.

22 cement plants are now operating a total of 104 Oliver United Filters. 10 more units are now being installed by three other companies. Filter operations at these plants have definitely shown that this mechanical method of removing water from the slurry before it enters the kilns cuts fuel bills 20-25%.

Under existing conditions this saving may mean the difference between profit and loss.

OLIVER UNITED SLURRY FILTERS spell economy whether used in connection with coal or gas fired kilns, regardless of how short or long, large or small the kiln may be.

Write for complete details today

OLIVER UNITED FILTERS INC.

All Oliver United Features
POINT TO PROFIT

FUEL SAVING

The saving of 20-25% in fuel is an advantage of vital interest to every cement plant looking towards lower production costs.

INCREASED KILN CAPACITY

An increase of 20-40% in kiln capacity is not an issue at many plants at present, but this feature may mean that one or more kilns may be shut down and desired plant capacity still maintained.

MORE UNIFORM BURNING

Resulting in more uniform clinker and easier grinding.

BETTER RAW GRINDING

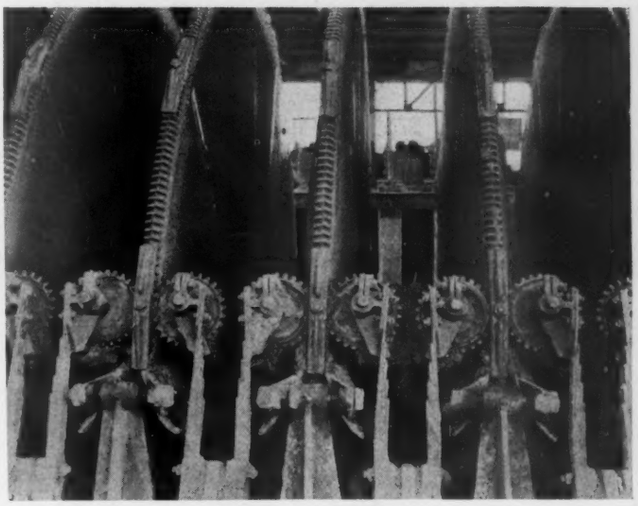
At a number of filter equipped plants, an increase of 2 to 3 percentage points in moisture resulted in higher mill capacity, increased slurry fineness and reduced power consumption.

UTILIZATION OF FLUE AND PRECIPITATOR DUST

Dust collected in kiln housings, boilers and dust precipitators is fed to kiln along with the filter cake, thus utilizing it for cement production.

SAVING IN WATER

Where water is purchased, the saving and reuse of about 60% of it makes a big cut in operating costs.



Let us tell you how OLIVER UNITED SLURRY FILTERS are helping to reduce operating costs in many such installations as illustrated.

OLIVER UNITED FILTERS, INC.

SAN FRANCISCO
Federal Reserve Bank Bldg.

NEW YORK
33 West 42nd Street

CHICAGO
221 North La Salle Street

TORONTO
330 Bay Street

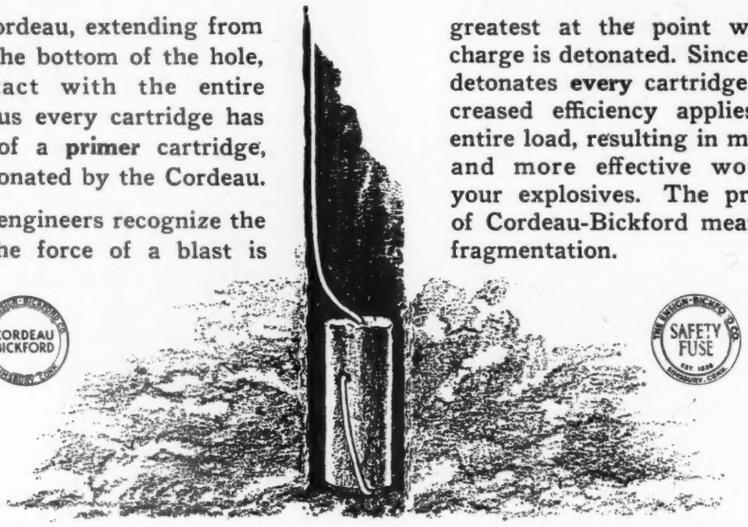
Dorr-Oliver N. V. THE HAGUE
Dorr-Oliver Co., Ltd. LONDON
Soc. Dorr-Oliver PARIS
Dorr-Oliver, G.m.b.H. BERLIN
Andrews & George Co., Inc. TOKYO
Edward J. Nell Co. MANILA
E. L. Bateman, Pty., Ltd. JOHANNESBURG
Ayres & Son RECIFE, BRAZIL
Crossle & Duff, Pty., Ltd. MELBOURNE
Van Lelyveld & Co. SOERABAJA, JAVA

Affiliated with
THE DORR CO. INC. Engineers

Every cartridge is a primer cartridge with this *insensitive* detonator

A line of Cordeau, extending from the top to the bottom of the hole, is in contact with the entire charge. Thus every cartridge has the effect of a **primer** cartridge, for it is detonated by the Cordeau.

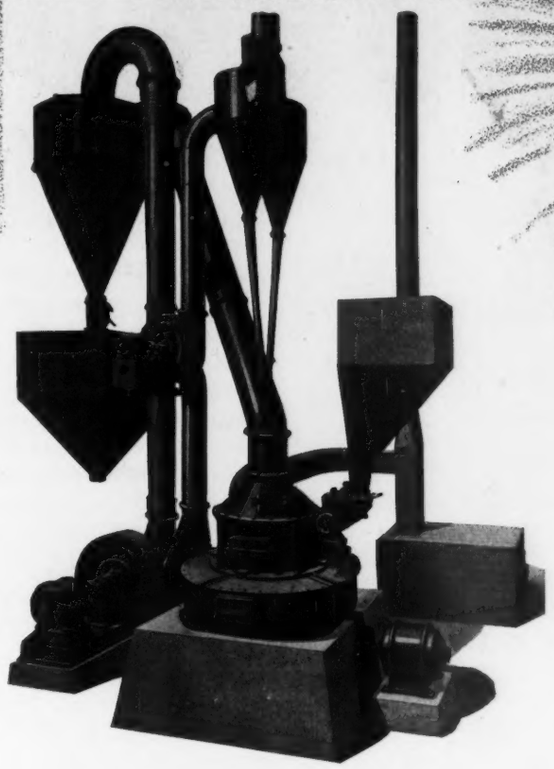
Explosives engineers recognize the fact that the force of a blast is greatest at the point where the charge is detonated. Since Cordeau detonates **every** cartridge, this increased efficiency applies to the entire load, resulting in more work and more effective work from your explosives. The proper use of Cordeau-Bickford means better fragmentation.



CORDEAU DETONATING FUSE BICKFORD

The ENSIGN-BICKFORD COMPANY - SIMSBURY - CONN.

ROLLER MILL ECONOMY for 1933



THE NEW RAYMOND ROLLER MILL

IS the advanced type of equipment you need to modernize your plant for greater profits in 1933. It is the latest development in pulverizing machinery with many mechanical refinements that reduce production costs to a record low level. The new oil journal and efficient lubrication system for all bearings, cut down power consumption and maintenance expense to a minimum. Automatic feed, convenient operation, fineness control, air separation and pneumatic conveying, all contribute to the economy of the New Raymond Roller Mill. It is built extra sturdy to stand hard service in the rock products industry, and made in capacities from one to forty tons per hour. It may be equipped with the air drying system and operated as a Kiln Mill for grinding and drying materials in one continuous process. This method shows large savings in pulverizing limestone, gypsum, coal and other non-metallic minerals. If you have a special pulverizing problem, write for information.

Send for your copy of the "Roller Mill Catalog" —it gives the latest data on modern methods of pulverizing and separating.

FEATURES That Cut Costs

•

New Type Oil Journal
reduces maintenance and lubrication costs to a minimum.

Pneumatic Feed Control
regulates "load" on mill for maximum grinding efficiency.

Concentrator Collector
cleans venting air of superfine dust.

Welded Seam Steel Piping
makes tight, rigid joints and insures dustless operation.

Fan in Return Air Line
eliminates abrasive wear on fan blades.

Massive Construction
cuts down vibration and adds years to the service life of mill.

ORIGINATORS OF AIR SEPARATION
PIONEERS OF PULVERIZING
SINCE 1887

RAYMOND BROS. IMPACT PULVERIZER CO.

Main Office and Works:
1307 North Branch Street, Chicago
Eastern Office: 200 Madison Avenue, New York
Western Office: Subway Terminal Bldg., Los Angeles

This is an opportune time to

MODERNIZE YOUR CEMENT PLANT

by the installation of modern economical machinery and technical improvements in layout and process.

F. L. Smidth & Co. manufacture the following complete line of modern

CEMENT PLANT MACHINERY

UNIDAN three-compartment grinding machine.
UNI-KOM four-compartment grinding machine.
KOMINUTER for wet and dry grinding.
TUBEMILL for wet and dry pulverizing.
TRIX for grading wet granulated material.
COAL MILLS for grinding coal.
SPRAY CASINGS for pulverizers.
CYLPEBS metallic grinding bodies.
DRAGPEB metal lining for pulverizers.
SILEX flint liners for pulverizers.
WASHMILL for disintegrating and mixing materials in water.
AGITATORS for mixing and storing wet composition.

ROTARY KILNS.
UNAX KILNS, rotary kilns with external concentric cooling drums.
UNAX COOLERS for existing kilns.
COOLERS—rotary pressure coolers.
CHAIN SYSTEM for kilns.
KILN CONTROL, electrical.
KILN EQUIPMENT, as hoods, dampers, spouts, airseals, dust chambers.
MOLER insulating bricks for kilns, etc.
COAL FEEDERS for rotary kilns.
COAL BURNERS for rotary kilns.
GAS BURNERS for rotary kilns.
OIL BURNING EQUIPMENT for rotary kilns.

FLUXO PUMP for pneumatic transport.
FLUXO PACKER for filling bags.
EXBINER for discharging bulk cement.
SKIPULTER shaker conveyor.
CYLCUP distributing conveyor.
SLURRY FEEDERS for kilns and mills.
CRADLE FEEDERS for crushed coal, rock, clinker, etc.
TABLE FEEDERS for coal, rock, clinker, etc.
PUMPS for cement slurry.
SYMETRO Drives, speed reduction units.
LENIX short center belt drive.
FLOURMETER for determining micron sizes in finely ground cement, etc.

In addition, F. L. Smidth & Co. are engineer specialists in designing and equipping factories for making portland cement, having devoted their efforts exclusively to this industry for a period of fifty years.

Their engineering services include all stages of the project from the preliminary investigation of the site and raw material deposits, chemical and physical tests of the raw materials and finished cement, to all necessary drawings and specifications for erecting and equipping all departments of the plant, including also the electrical engineering.

This service applies equally well to complete new plants or any special department of a plant—to revisions or conversions of existing plants—making standard portland cement, slag cements, white cement, or for making special high early strength cements, such as "VELO."

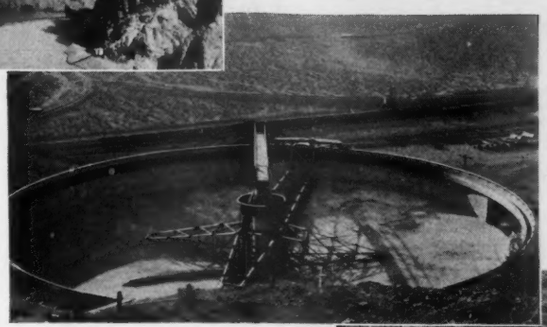
F. L. SMIDTH & CO.

225 BROADWAY **NEW YORK, N. Y.**

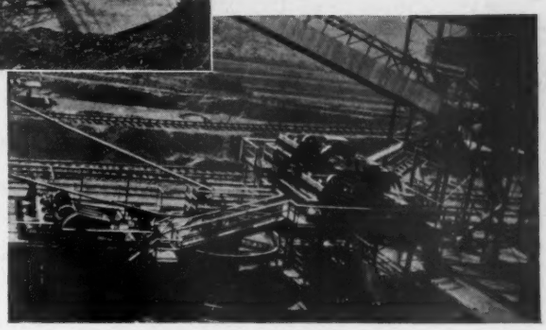
AT HOOVER DAM . . .

Dorr Classifiers Wash and Grade the Sand

Black Canyon, site of the dam.



Dorr Traction Thickener, 150 ft. dia.



Two Type F Dorr Classifiers and one Dorr Bowl Classifier at the aggregate plant.

OBSOLETE, out-dated equipment is conspicuous by its absence at the site of the Hoover Dam project, near Boulder City, Nevada. Six Companies Inc., the contractors, are taking no chances with questionable machinery or methods on a 727 foot irrigation dam costing close to $50,000,000 and requiring about 5,500,000 barrels of cement and 5,500,000 pounds of reinforcing steel.

Construction is going forward orderly and systematically with military precision. Costs are figured and refigured on mills, not cents, per unit. No breakage or shut down can even be thought of, with a $3,000 a day penalty chargeable for failure to complete the project within the time specified in the contract.

Dorr Classifiers and a Dorr Thickener were selected for the important task of washing and grading the sand and desilting the wash water so that it might be reused over and over again. Operating continuously at 200 tons per hour, the three series-connected Dorr Classifiers make separations at 28, 48 and 200 mesh. These three products are continuously combined in the proper proportions to give a thoroughly washed concrete sand of the desired fineness modulus. The silt-laden water from the washing plant, 3500-4000 gals. per minute, is clarified and made available for reuse in a Dorr Thickener with a storage capacity of 400,000 gallons.

Are you equipped to produce the type of washed, specification sand that will be demanded in 1933? If you are a large producer, a Dorr Classifier installation, like the one at Hoover Dam, will remove all doubt on this score. If you are a small or moderately sized producer, the smaller and less expensive Dorrco Sand Washer will give you the same trouble-free service and control of quality.

Write for Bulletin 4101 on Sand Washing

DORRCO

THE DORR COMPANY, INC.

ENGINEERS • 247 PARK AVENUE, NEW YORK

DENVER CHICAGO LOS ANGELES TORONTO

Affiliated with OLIVER UNITED FILTERS INC. Engineers

Dorr technical services and equipment are available from the following companies:

HOLLAND: Dorr-Oliver N. V. The Hague
FRANCE: Soc. Dorr-Oliver, Paris
ENGLAND: Dorr-Oliver Company Ltd., London
AUSTRALIA: Crossle & Duff Pty. Ltd., Melbourne
SOUTH AFRICA: Edward L. Bateman Pty. Ltd., Johannesburg
GERMANY: Dorr-Oliver Gesellschaft, m. b. H. Berlin
JAPAN: Andrews & George Co. Inc., Tokyo

Classified Directory of Advertisers in this Issue of Rock Products

For alphabetical index, see page 104

This classified directory of advertisers in this issue is published as an aid to the reader. Every care is taken to make it accurate, but ROCK PRODUCTS assumes no responsibility for errors or omissions. The publishers will appreciate receiving notice of omissions or errors, or suggestions

Acetylene Welding Rod
Haynes Stellite Co.

Agitators, Thickeners and Slurry Mixers
The Dorr Co.
Hardinge Company, Inc.
F. L. Smidth & Co.

Air Compressors
De Laval Steam Turbine Co.
Fuller Co.
Nordberg Mfg. Co.
Traylor Eng. & Mfg. Co.

Air Filters
Fuller Co.

Air Separators
Hardinge Company, Inc.
Kent Mill Co.
Raymond Bros. Impact Pulv. Co.
Sturtevant Mill Co.

Alloys
Haynes Stellite Co. (Metal)

Ash and Refuse Handling Equipment
The Hayward Co.

Babbitt Metal
Joseph T. Ryerson & Son, Inc.

Backfillers
Bucyrus-Erie Company
Harnischfeger Corp.
Ohio Power Shovel Co.

Ball Bearings
SKF Industries, Inc.

Balls, Grinding (See Grinding Balls)

Balls (Tube Mill, etc.)
Allis-Chalmers Mfg. Co.
Hardinge Company, Inc.
Lorain Steel Co.
F. L. Smidth & Co.

Bearings
Chain Belt Co.
Haynes Stellite Co.
Link-Belt Co.
SKF Industries, Inc.

Bearings (Anti-Friction)
SKF Industries, Inc.

Bearings (Roller)
SKF Industries, Inc.

Bearings (Thrust)
SKF Industries, Inc.

Bins
Good Roads Machinery Co., Inc.
Traylor Eng. & Mfg. Co.
Universal Crusher Co.

Bin Gates
Chain Belt Co.
Fuller Co.
Good Roads Machinery Co., Inc.
Link-Belt Co.
Traylor Eng. & Mfg. Co.

Blast Hole Drills (See Drills, Blast Hole)

Blasting Machines
Atlas Powder Co.

Blasting Powder (See Powder, Blasting)

Blasting Supplies
Atlas Powder Co.
Hercules Powder Co.

Blocks (Pillow, Roller Bearing)
Link-Belt Company
SKF Industries, Inc.

Blowers
De Laval Steam Turbine Co.

Boilers
Combustion Engineering Corp.

Breakers (Primary)
Smith Eng. Works

Buckets (Dragline and Slackline)
Bucyrus-Erie Co.
The Hayward Co. (Dragline)
The Owen Bucket Co.
Wellman Eng. Co. (G. H. Williams Co.)

Buckets (Dredging and Excavating)
Harnischfeger Corp.
The Owen Bucket Co.
Wellman Engineering Co. (G. H. Williams Co.)

Buckets (Elevator and Conveyor)
Cross Engineering Co.
The Hayward Company
Hendrick Mfg. Co.
Link-Belt Co.

Buckets (Clamshell, Grab, Orange Peel, etc.)
Harnischfeger Corp.
The Hayward Co.
Link-Belt Co.
The Owen Bucket Co.
Wellman Engineering Co. (G. H. Williams Co.)

Cableways
American Steel & Wire Co.
Broderick & Bascom Rope Co.
General Electric Co.
The Hayward Company
Link-Belt Co.
Wellman Eng. Co. (G. H. Williams Co.)
Williamsport Wire Rope Co.

Cap Crimpers and Fuse Cutters
Ensign-Bickford Co.

Caps (Blasting)
Atlas Powder Co.
Hercules Powder Co.

Car Pullers
Link-Belt Co.

Cars (Dump)
Lorain Steel Co.

Cars (Quarry and Gravel Pit)
Easton Car & Construction Co.
Lorain Steel Co.

Castings
Babcock & Wilcox Co.
Eagle Iron Works (Grey Iron)
Haynes Stellite Co.
Link-Belt Co.

Cement Making Machinery
F. L. Smidth & Co.

Cement Pumps
Fuller Co.
F. L. Smidth & Co.

Central Mixing Plants (Concrete)
Chain Belt Co.

Chain (Dredge and Steam Shovel)
Bucyrus-Erie Co.

Chain (Elevating and Conveying)
Chain Belt Co.
Link-Belt Company

Chain Drives
Chain Belt Co.

Chain Feeders and Screens
Ross Screen & Feeder Co.

Chain Systems (Kilns)
F. L. Smidth & Co.

Chutes and Chute Liners
Cross Engineering Co.

Chutes (Stope, Feed Controllers)
Ross Screen & Feeder Co.

Clamshell Buckets (See Buckets, Clamshell, Grab, etc.)

Clarifiers
The Dorr Co.
Hardinge Company, Inc.

Classifiers
The Dorr Co.
Link-Belt Company

Clips (Wire Rope)
Broderick & Bascom Rope Co.
Williamsport Wire Rope Co.

Clutches
Fairbanks, Morse & Co.

Coal Pulverizing Equipment
Babcock & Wilcox Co.
Hardinge Company, Inc.
Pennsylvania Crusher Co.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.

Compressors (See Air Compressors)

Concentrators (Slurry, etc.)
The Dorr Co.

Concrete Mixers (See Mixers)

Controllers (Electric)
Fairbanks, Morse & Co.

Conveyor Idlers and Rolls
Chain Belt Co.
Link-Belt Co.

Conveyors and Elevators
Earle C. Bacon, Inc.
Chain Belt Co.
Fuller Company
Good Roads Machinery Co., Inc.
The Hayward Company
The Jeffrey Mfg. Co.
Lewistown Fdy. & Mach. Co.
Link-Belt Co.
F. L. Smidth & Co.
Smith Engineering Works
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.
Universal Crusher Co.

Conveyors (Pneumatic)
Fuller Company

Conveyors (Screw)
Link-Belt Co.

Coolers (See Kilns and Coolers, Rotary)

Correcting Basins
F. L. Smidth & Co.

Couplings (Flexible and Shaft)
Chain Belt Co.
De Laval Steam Turbine Co.
Link-Belt Company

Cranes (Clamshell)
Bucyrus-Erie Co.
Harnischfeger Corp.

Cranes (Crawler and Locomotive)
Bucyrus-Erie Co.
Harnischfeger Corp.
Link-Belt Co.
Ohio Power Shovel Co.

Cranes (Gantry)
The Hayward Co.

Cranes (Overhead Traveling Electric)
Harnischfeger Corp.

Crushers (Hammer)
Dixie Machinery Mfg. Co.
Lorain Steel Co.
Pennsylvania Crusher Co.
Sturtevant Mill Co.

Crushers (Jaw and Gyratory)
Allis-Chalmers Mfg. Co.
Earle C. Bacon, Inc. (Jaw)
Good Roads Machinery Co., Inc.
Lewistown Fdy. & Mach. Co.
Nordberg Mfg. Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Crusher Co.

Crushers (Single Roll)
The Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.

Crushing Rolls
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.

Derricks and Derrick Fittings
Harnischfeger Corp.
The Hayward Company
Wellman Eng. Co. (G. H. Williams Co.)

Detonators
Atlas Powder Co.

Dewatering Machines
The Dorr Co.

Diesel Engines (See Engines, Diesel)

Dippers and Teeth (Steam Shovel)
Bucyrus-Erie Co.
The Frog, Switch & Mfg. Co.
The Hayward Co.

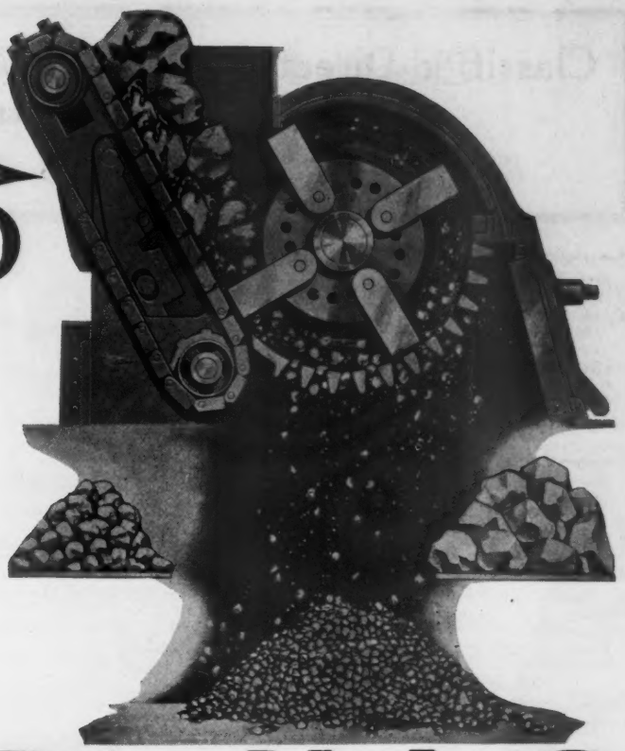
Ditchers
Bucyrus-Erie Co.
Harnischfeger Corp.
The Hayward Co.

Draglines
Bucyrus-Erie Co.
Harnischfeger Corp.
Link-Belt Co.

WEARING AREA INCREASED 26 TIMES!

A FEATURE OF

DIXIE HAMMERMILLS



This special moving breaker plate assures twenty-six times the wearing area of any standard type of breaker plate—practically eliminating adjustment at this point.

The DIXIE Mogul Non-Clog Hammermill is a large capacity crusher especially adapted for cement plants and quarries, that will reduce Limestone, Shale, Gypsum, Lime, Brick, Clay, Kaolin, Fuller's Earth, Asphalt Rock, Barytes, Coal and Marl to any uniform given size in one operation at the least possible cost.

The Movable Breaker Plate carries the material right to the hammer points, which eliminates all necessity of extra men at the feed hopper—a feature that has saved the cost of ten men in the crushing department of a well known cement plant.

The sturdy and simple construction of every DIXIE Hammermill Unit guarantees a long life and uninterrupted service—even under the most unfavorable conditions.

Decide now to modernize your crushing requirements with the installation of a DIXIE Hammermill. Write for the DIXIE Catalog

DIXIE MACHINERY MFG. CO.

4209 GOODFELLOW ST. ST. LOUIS, MO.

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 104

Dragline Excavators
Bucyrus-Erie Co.
Harnischfeger Corp.
The Hayward Co.
Ohio Power Shovel Co.

Dragline Cableway Excavators
Bucyrus-Erie Co.
Good Roads Machinery Co., Inc.
Link-Belt Co.

Dragline Excavators (Walking)
Bucyrus-Monighan Company

Drag Scrapers (See Scrapers, Power Drag)

Dredge Chain (See Chain)

Dredges
Bucyrus-Erie Co.
The Hayward Company
Morris Machine Works

Drilling Accessories
Loomis Machine Co.

Drills (Blast Hole)
Loomis Machine Co.

Drills (Well) (See Drills, Blast-Hole)

Drives (Short Center)
Allis-Chalmers Mfg. Co.
Fairbanks, Morse & Co.

Drives (Worm)
De Laval Steam Turbine Co.

Dryers
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Combustion Engineering Corp.
Ruggles-Coles Div. of Hardinge Co.
Traylor Eng. & Mfg. Co.
Arthur Wright & Associates (Cement Slurry)

Dust Collecting Systems
Allis-Chalmers Mfg. Co.

Dust Conveying Systems
Fuller Co.

Dynamite
Atlas Powder Co.
Hercules Powder Co.

Electric Mine Hoists
Nordberg Mfg. Co.

Electric Power Equipment
Allis-Chalmers Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.

Elevators (See Conveyors and Elevators)

Emery Mills
Sturtevant Mill Co.

Engineers
The Dorr Co.
Productive Equipt. Corp.
F. L. Smidth & Co.
Sturtevant Mill Co.

Engines (Diesel)
Fairbanks, Morse & Co.
Nordberg Mfg. Co.

Engines (Kerosene, Gasoline and Oil)
Fairbanks, Morse & Co.

Engines (Steam)
Morris Machine Works

Excavating Machinery (See Shovels, Cranes, Buckets, etc.)

Explosives
Atlas Powder Co.
Hercules Powder Co.

Fans
General Electric Co.

Feeders
Babcock & Wilcox Co. (Pulverized Coal)
Fuller Co. (Cement and Pulverized Material)
Ross Screen & Feeder Co. (Chain)
Smith Engineering Works (Plate)

Feeders (Weighing)
Hardinge Company, Inc.

Filter Cloth
Oliver United Filters Inc.
Arthur Wright & Associates

Filters (Cement Slurry)
Oliver United Filters Inc.
Arthur Wright & Associates

Filters and Strainers (Gasoline)
Alemite Corp.

Furnaces
Combustion Engineering Corp.

Fuses (Detonating and Safety)
Ensign-Bickford Co.

Fuses (Electric)
General Electric Co.

Gates, Bin (See Bin Gates)

Gear Reducers
De Laval Steam Turbine Co.

Gears (Herringbone)
De Laval Steam Turbine Co.

Gears (Spur, Helical, Worm)
De Laval Steam Turbine Co.

Gears and Pinions
De Laval Steam Turbine Co.
General Electric Co.
Link-Belt Co.

Gelatin and Semi-Gelatin (See Explosives)

Generating Sets (Diesel Electric)
Fairbanks, Morse & Co.

Grab Buckets (See Buckets, Clamshell, Grab, etc.)

Grapples
The Hayward Co.

Grapples (Stone)
Wellman Eng. Co. (G. H. Williams Co.)

Grease
Alemite Corp.

Grinding Balls
Babcock & Wilcox Co.
Lorain Steel Co.

Grizzlies
Good Roads Machy. Co., Inc.
Productive Equipt. Corp.
Ross Screen & Feeder Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.

Grizzly Feeders
Ross Screen & Feeder Co.
Traylor Eng. & Mfg. Co.

Hammer Mills (See Crushers)

Hard Facing Materials
Haynes Stellite Co.

Hascrome
Haynes Stellite Co.

Hastelloy
Haynes Stellite Co.

Hoists
Harnischfeger Corp.
The Hayward Co. (Steam, Gasoline and Electric)
Link-Belt Co.

Insulation (Electric)
General Electric Co.

Kilns and Coolers (Rotary)
Allis-Chalmers Mfg. Co.
Hardinge Company, Inc.
F. L. Smidth & Co.
Traylor Eng. & Mfg. Co.

Kilns (Shaft)
Hardinge Company, Inc.

Kominuters (See Mills)

Laboratory Crushers
Sturtevant Mill Co.

Lighters (Hot Wire for Safety Fuse)
Ensign-Bickford Co.

Lime Handling Equipment
Fuller Co.
Hardinge Company, Inc.
Link-Belt Co.
Raymond Bros. Impact Pulv. Co.

Linings (Iron for Ball and Tube Mills) (See Mill Liners)

Loaders and Unloaders
Bucyrus-Erie Co.
Good Roads Machinery Co., Inc.
The Hayward Co.
Link-Belt Co.
Ross Screen & Feeder Co.
Wellman Eng. Co. (G. H. Williams Co.)

Locomotive Cranes (See Cranes, Crawler and Locomotive)

Locomotives (Diesel)
Fate-Root-Heath Co.
Plymouth Locomotive Works

Locomotives (Diesel-Electric)
Fate-Root-Heath Co.
Plymouth Locomotive Works

Locomotives (Gas Electric)
Fate-Root-Heath Co.
Plymouth Locomotive Works

Locomotives (Geared)
Lima Locomotive Works, Inc.

Locomotives (Oil-Electric)
Fate-Root-Heath Co.
Plymouth Locomotive Works

Locomotives (Steam, Gas and Electric)
Fate-Root-Heath Co. (Gas)
General Electric Co.
Lima Locomotive Works, Inc. (Steam)
Plymouth Locomotive Wks. (Gas)

Locomotives (Storage Battery)
General Electric Co.

Log Washer
McLanahan & Stone Corp.
Smith Eng. Works

Lubricants
Alemite Corp.
Broderick & Bascom Rope Co. (Wire Rope)

Lubricating Fittings
Alemite Corp.

Lubricating Systems
Alemite Corp.

Machine Parts
Haynes Stellite Co.

Machinery Guards
Harrington & King Perforating Co.

Magnets
General Electric Company

Manganese Steel Castings
The Frog, Switch & Mfg. Co.

Metals (Acid and Corrosion Resistant)
Haynes Stellite Co.

Mills, Grinding (Ball, Tube, etc.) (See also Crushers, Hammer)
Allis-Chalmers Mfg. Co.
Hardinge Company, Inc.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Traylor Eng. & Mfg. Co.

Mill Liners and Linings (Iron for Ball and Tube Mills)
Babcock & Wilcox Co.
Hardinge Company, Inc.
Lorain Steel Co.
F. L. Smidth & Co.

Mixers (Commercial Concrete)
Jaeger Machine Co.

Molds (Concrete Pipe)
Universal Concrete Pipe Co.

Motors and Generators (Electric)
Allis-Chalmers Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
Harnischfeger Corp.

Motor Truck Scales
Fairbanks, Morse & Co.

Oil (Motor)
Alemite Corp.

Oils (Graphite)
Alemite Corp.

"Red Letter" Days *for* Sales Concentration

THE machinery and equipment manufacturers selling the crushed stone, sand and gravel, and ready mixed concrete industries will look upon the concentration of maximum buying power in these three big markets as marking the 16th, 17th 18th, 19th, and 20th of January as the "red letter" days of 1933 for sales.

Three great National Associations whose membership constitutes a concentrated production capacity in the three industries they represent, have combined their expositions during their annual conventions to be held at the Book-Cadillac Hotel, Detroit, during the week of January 16th, 1933.

The National Crushed Stone Association, the National Ready Mixed Concrete Association and the National Sand and Gravel Association, by thus merging three major markets into one, have effected real economy in the cost of exhibiting. There is considerable duplication in the equipment used by producers in these fields. This joint Exposition permits displaying products ***"once and for all."***

This novel arrangement reduces net exhibition costs, expenses for transporting equipment and salesmen, cost of rooms and meals, and shortens the time that sales organizations must devote to their exhibits.

The Highway and Building Congress will also bring men in many related industries in the construction world to Detroit that week, increasing the market range of your product.

Every sales manager will hail this sales Utopia where the most influential users of his product are brought together . . . where three large sales territories are compressed into one small floor space . . . where his products secure the widest visual appeal to a cordial and receptive audience.

The wide-awake sales manager will take immediate steps to gain that Utopia. He will reserve his exhibit space for those five red letter days—right—now!

●

JANUARY 16TH to 20TH 1933

BOOK-CADILLAC DETROIT

Joint Exposition and concurrent Conventions of National Sand and Gravel Assn., National Ready Mixed Concrete Assn., and National Crushed Stone Assn.

●

JOINT EXPOSITION

NATIONAL CRUSHED STONE ASSOCIATION
NATIONAL READY MIXED CONCRETE ASSN.
NATIONAL SAND AND GRAVEL ASSOCIATION

Room 951 Munsey Bldg. Washington, D. C.

Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

For alphabetical index, see page 104

Perforated Metal
Chicago Perforating Co.
Cross Engineering Co.
Harrington & King Perforating Co.
Hendrick Mfg. Co.
Morrow Mfg. Co.

Pipe Machines (Concrete)
Universal Concrete Pipe Co.

Portable Conveyors
Fuller Company
Link-Belt Co.

Portable Crushing and Screening Unit
Smith Eng. Works

Powder (Blasting)
Atlas Powder Company

Power Transmission Machy.
SKF Industries, Inc.

Power Units
Fairbanks, Morse & Co.

Pulverizers (See also Crushers, Mills, etc.)
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Dixie Machinery Mfg. Co.
Hardinge Company, Inc.
Kent Mill Co.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Sturtevant Mill Co.
Universal Crusher Co.

Pump Parts
Haynes Stellite Co.

Pumps (Acid Centrifugal)
Oliver United Filters, Inc.

Pumps (Air Lift)
Fuller Co.

Pumps (Cement)
Fuller Co.

Pumps (Cement Mill)
De Laval Steam Turbine Co.

Pumps (Cement Slurry)
The Dorr Company
Morris Machine Works
F. L. Smidth & Co.
A. R. Wilfley & Sons

Pumps (Centrifugal)
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
Fairbanks, Morse & Co.
Morris Machine Works
A. R. Wilfley & Sons

Pumps (Drainage)
De Laval Steam Turbine Co.
Fairbanks, Morse & Co.

Pumps (Dredging)
Bucyrus-Erie Co.

Pumps (Pulverized Coal)
Babcock & Wilcox Co.

Pumps (Sand and Gravel)
Allis-Chalmers Mfg. Co.
Morris Machine Works
A. R. Wilfley & Sons

Railways (Electric)
General Electric Co.

Railway Equipment
General Electric Co.

Road Machinery
Good Roads Machinery Co., Inc.
Harnischfeger Corp.

Rod Mills
Hardinge Company, Inc.
Traylor Eng. & Mfg. Co.

Rolled Stock (For Liners, etc.)
Haynes Stellite Co.

Roller Bearings
SKF Industries, Inc.

Roofing and Siding (Steel)
Joseph T. Ryerson & Son, Inc.

Rope (Wire) (See Wire Rope)

Sand and Gravel Handling Equipment
Link-Belt Co.

Sand Drag
Smith Eng. Works

Sand Separators
Link-Belt Co.

Sand Settling Tanks
Link-Belt Co.
Smith Engineering Works

Scales (Automatic Proportioning)
Fairbanks, Morse & Co.

Scales (Cement)
Fairbanks, Morse & Co.

Scales (Railway Track and Truck)
Fairbanks, Morse & Co.

Scrapers (Power Drag)
Harnischfeger Corp.
The Hayward Co.
Link-Belt Co.

Screens
Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
Cross Engineering Co.
Good Roads Machinery Co., Inc.
Hardinge Company, Inc.
Harrington & King Perf. Co.
Kent Mill Co.
Link-Belt Co.
Lorain Steel Co.
Morrow Mfg. Co.
National Wire Cloth Co.
Niagara Roller Bearing Screen Co.
Productive Equipt. Corp.
Ross Screen & Feeder Co.
Smith Eng. Works
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.
Universal Crusher Co.
Universal Vibrating Screen Co.

Screens, Scalping (Hercules and Standard)
Smith Eng. Wks.

Screens (Self Feeding)
Ross Screen & Feeder Co.

Screens, Vibrating
Link-Belt Co.
Niagara Roller Bearing Screen Co.
Productive Equipt. Corp.
Smith Engineering Works
Sturtevant Mill Co.
Universal Vibrating Screen Co.

Screens, Washing (Hercules, Ajax and Standard)
Smith Eng. Wks.

Screw Rewasher (Single and Twin Screw)
Smith Eng. Wks.

Scrubbers (Gyrating Tube)
Niagara Roller Bearing Screen Co.

Seal Rings
Traylor Eng. & Mfg. Co.

Separators, Air (See Air Separators)

Separators (Slurry)
F. L. Smidth & Co.

Shovels, Power (Steam, Gas, Electric, Diesel, Oil)
Bucyrus-Erie Company
Harnischfeger Corp.
Link-Belt Co.
Ohio Power Shovel Co.

Silos
F. L. Smidth & Co.

Skip Hoists and Skips
Link-Belt Co.

Slings (Wire Rope)
American Steel & Wire Co
A. Leschen & Sons Rope Co.
Williamsport Wire Rope Co.

Slugs (Wire Rope)
American Steel & Wire Co.

Solvents (Carbon)
Alemite Corp.

Speed Reducers
De Laval Steam Turbine Co.
Link-Belt Co.
Traylor Eng. & Mfg. Co.

Speed Reducers (Herringbone)
De Laval Steam Turbine Co.

Spouts, Chutes (See Chutes and Chute Liners)

Steel (Bars, Shapes, Plates, etc.)
Joseph T. Ryerson & Son, Inc.

Stellite
Haynes Stellite Co.

Stokers
Combustion Engineering Corp.

Tanks
Combustion Engineering Corp.
The Dorr Co.
Link-Belt Co.

Thickeners
The Dorr Co.
Hardinge Company, Inc.

Tools, Drill (See Drilling Accessories)

Track Equipment
Lorain Steel Co.

Track Shifters
Nordberg Mfg. Co.

Tramways (Aerial Wire Rope)
American Steel & Wire Co.
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.
Williamsport Wire Rope Co.

Transmission Machinery
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.

Troughs
Cross Eng. Co.

Truck Bodies (Quarry)
Easton Car & Const. Co.

Truck Bodies (Ready Mixed Concrete)
Jaeger Machine Co.

Trucks (Mixers)
Jaeger Machine Co.

Tube Mills (See Mills, Ball, Tube, etc.)

Tube Mill Liners (See Mill Liners)

Turbines (Steam and Water)
De Laval Steam Turbine Co.

Turbo-Generators
De Laval Steam Turbine Co.

Underground Shovels
Nordberg Mfg. Company

Valves
Haynes Stellite Co.

Vibrating Screens (See Screens, Vibrating)

Washers (Sand, Gravel and Stone)
Allis-Chalmers Mfg. Co.
The Dorr Co.
Eagle Iron Works
Link-Belt Co.
Niagara Roller Bearing Screen Co.
Traylor Eng. & Mfg. Co.

Waste Heat Boilers
Combustion Engineering Corp.

Weighing Equipment
Fairbanks, Morse & Co.

Welding and Cutting Apparatus
General Electric Co.
Harnischfeger Corp.

Welding Rod
Haynes Stellite Co.

Welding Rod (Composite)
Haynes Stellite Co.

Welding Wire
American Steel & Wire Co.

Well Drills (See Drills, Blast Hole)

Wire Cloth
National Wire Cloth Co.

Wire Rope
American Steel & Wire Co.
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.
Williamsport Wire Rope Co.

Wire Rope Fittings
American Steel & Wire Co.
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.
Williamsport Wire Rope Co.

Wire Rope Slings (See Slings, Wire Rope)

Worm Gears (See Gears)

Making Convention HISTORY!!!

THREE big conventions, held at the same time and in the same place, mark an epoch in trade gatherings of significance to all producers of crushed stone, sand and gravel, and ready mixed concrete.

Concurrent conventions, but with independent sessions, will be held by the National Sand and Gravel Association, the National Ready Mixed Concrete Association and the National Crushed Stone Association, at the Book-Cadillac Hotel, Detroit, during the week of January 16th, 1933.

This unique arrangement offers unusual reasons for attendance by ***everyone*** whose business interests are connected with these industries, whether an Association member or not. "Everyone" includes superintendents and operating men as well as executives—the full personnel—because low railroad rates permit companies to send twice their usual number of convention representatives for practically the same cost as other years.

Round-trip fares to Detroit for the three conventions have been reduced to one and one-ninth the cost of one-way fares! This is making convention history in the matter of transportation expense.

The three associations will participate in a joint Congress smoker, joint banquet, and will hold a Joint Exposition of machinery and equipment used in the production, distribution and consumption of products in these industries. This "pooling" arrangement secures lower rates for fees, rooms and meals than would be the case if each convention were held at a different time, in a different hotel, in a different city.

Thus is convention history being made in economy and convenience of arrangements,—for the main activities and sessions of all three conventions, the Joint Exposition, registration booths and headquarters are under the same roof.

The Joint Exposition assures producers that America's foremost manufacturers will be eager to exhibit their products to three such closely related industries at one time. Constant changes take place in the processes and products of these industries, and every producer will want to see the latest developments and improvements in equipment for increasing production efficiency and economy.

The same week, in Detroit, many related organizations and individuals in the construction industry will attend the Highway & Building Congress. A dramatic mobilization of all interests in the construction world will cooperate to educate the nation to the economic necessity of "carrying on" with a broad program of construction.

What a climax to this history-making event! ***You*** can't afford to have any man in your organization miss it. All will be more productive employees for having attended. But—it is imperative that you make up your list—NOW—and send in your firm's reservations—TODAY!

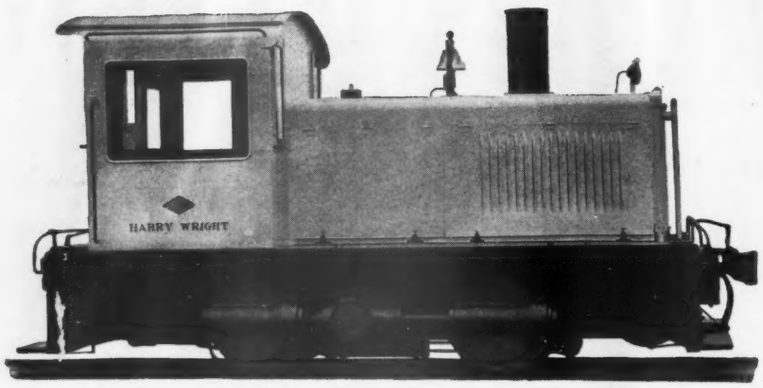
A
3-in-1
Exhibit

Held jointly with the Annual Conventions of National Sand and Gravel, National Ready Mixed Concrete, and National Crushed Stone Associations

Book-Cadillac Hotel
Detroit
Jan. 16-20, 1933

NATIONAL CRUSHED STONE ASSOCIATION
NATIONAL READY MIXED CONCRETE ASSN.
NATIONAL SAND AND GRAVEL ASSOCIATION

LOW DRIVE MAINTENANCE
On LIMA Gasoline Locomotives



LOW drive maintenance is assured on Lima Gasoline Locomotives. The Lima drive is different from other drives.

On Lima Gasoline Locomotives, power is transmitted to both axles through gearing to a universal gear drive. This distinctive method of drive eliminates chains and side rods. Not having to make the adjustments required by these parts, operators of Lima Gasoline Locomotives are enabled to keep their drive maintenance at a minimum.

LIMA LOCOMOTIVE WORKS
Incorporated
Lima, Ohio 60 E. 42nd St., New York, N. Y.

LIMA LOCOMOTIVE WORKS INCORPORATED

LIMA *Gasoline* LOCOMOTIVES

Free Service to Subscribers

RESEARCH SERVICE DEPARTMENT,
Rock Products and Cement and Engineering News,
542 So. Dearborn St., Chicago, Ill.

Please send me catalogs and prices concerning the following items checked below:

.....Air Compressors.	.....Classifiers.	.....Engines, Gasoline.	.....Magnetic Separators.	.....Rope, Manila.
.....Agitators.	.....Clips, Wire Rope.	.....Engines, Oil.	.....Mixers.	.....Safety Clothing, Etc.
.....Anvils.	.....Clutches.	.....Fire Brick.	.....Motors.	.....Sand-Lime Brick Machinery.
.....Bags.	.....Compressors.	.....Floor Tile Machines.	.....Motor Trucks.	.....Sand Pumps.
.....Bag Printing Machines.	.....Conveying Equipment.	.....Forges.	.....Moulds (Building Tile, Block, Burial Vault, Etc.)	.....Sand Washing Boxes.
.....Bagging Machines.	.....Conveyors.	.....Frogs and Switches.		.....Scrapers.
.....Belt Dressings.	.....Cranes.	.....Gas Producers.		.....Screening Equipment.
.....Belting, Conveying.	.....Crusher Parts.	.....Gear Speed Reducers.		.....Screening Plants.
.....Belting, Transmission.	.....Crushing Plants.	.....Gears.		.....Screens.
.....Bins.	.....Crushers.	.....Generators, Electric.		.....Sheaves.
.....Bin Gates.	.....Derricks.	.....Hand Shovels.		.....Steam Shovels.
.....Blast Hole Drills.	.....Dragline Excavators.	.....Hoisting Engines.		.....Steel, High Speed.
.....Blasting Powder.	.....Dragline Cableway Excavators.	.....Hoists.	.....Oil Storage.	.....Steel, Manganese.
.....Block Machines.		.....Hose, Air Drill.	.....Oils and Lubricants.	.....Stokers, Automatic.
.....Bodies, Motor Trucks.	.....Dredging Pumps.	.....Hose, Pneumatic Tool.	.....Packing, Hydraulic.	.....Tanks, Steel.
.....Boilers.	.....Drill Steel.	.....Hose, Steam.	.....Packing, Piston.	.....Tanks, Wood.
.....Brick Machines.	.....Drill Sharpening Machinery.	.....Hose, Water.	.....Packing, Sheet.	.....Tracks.
.....Buckets.	.....Drills, Blast Hole.	.....Hydraulic Dredges.	.....Packing, Superheat.	.....Track Material.
.....Buildings, Portable.	.....Drills, Hand Hammer.	.....Industrial Railways.	.....Paints and Coatings.	.....Transformers, Electric.
.....Cable Coatings.	.....Drills, Tripod.	.....Lights, Carbide.	.....Perforated Metal.	.....Unloaders.
.....Cableways.	.....Dryers, Sand and Stone.	.....Lime Hydrators.	.....Pipe, Iron.	.....Valves.
.....Calcining Machinery.	.....Dynamite.	.....Lime Kilns.	.....Pipe, Machines.	.....Washing Equipment.
.....Cars.	.....Dump Bodies.	.....Loaders, Jar.	.....Power Transmitting Equipment.	.....Weighing Equipment.
.....Car Pullers.	.....Dump Cars.	.....Loaders, Wagon.	.....Pulleys.	.....Welding, Electric.
..... Car Replacers.	.....Dump Wagons.	.....Locomotive Cranes.	.....Pulverizers.	.....Welding, Oxy-Acetylene.
.....Cement Brick Machines.	.....Dust Collecting Systems.	.....Locomotives, Electric.	.....Pumps, Centrifugal.	.....Winches.
.....Chain Drive.	.....Elevators and Conveyors.	.....Locomotives, Gasoline.	.....Pumps, Electric.	.....Wire Cloth.
.....Chain Hoists.	.....Elevating Equipment.	.....Locomotives, Steam.	.....Pumps, Gasoline.	.....Wire Rope.
.....Chains, Steel.	.....Engineering Service.	.....Locomotives, Storage Battery.	.....Pumps, Steam.	.....Wrenches.
		.....Machine Shop Equipment.	.....Pyrometers.	
			.....Rails.	
			.....Respirators.	
			.....Rock Drills.	
			.....Roofing Tile Machines.	
			.....Rope Drive.	

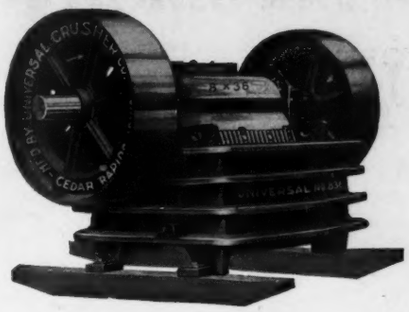
Firm Name.....

Individual.....

Address.....

City..... **State**.....

YOU MUST MAKE MONEY
OR WE BOTH LOSE . . .



We Therefore Make It Our Business

to consult with you in order that your equipment may be exactly suited to your job. We build a great variety of modern equipment designed to cut costs by speeding up production. What you should have to meet highly competitive conditions is our first consideration.

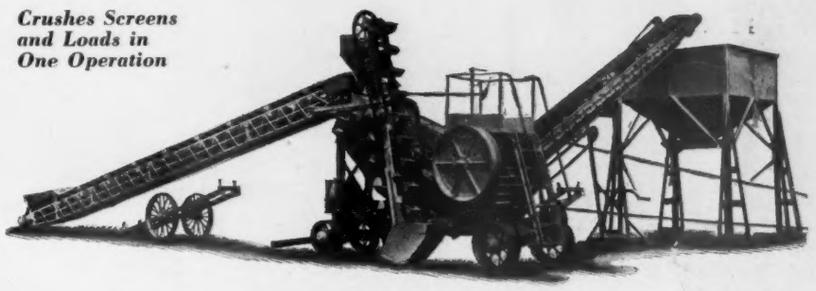
Stationary Plants...Portable Plants...Built to Order

Let us know your requirements for stone quarry or gravel pit and we shall be glad to give you the benefit of many years experience in the crushing equipment business.

Commercial plants are recognizing the need of portable equipment to supplement stationary setups.

Let us help you

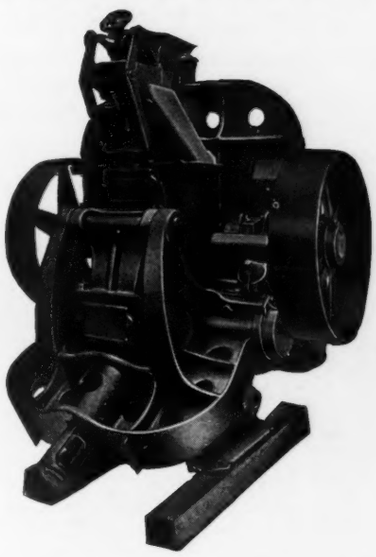
Crushes Screens and Loads in One Operation



UNIVERSAL CRUSHER COMPANY

617 C AVENUE WEST
CEDAR RAPIDS, IOWA

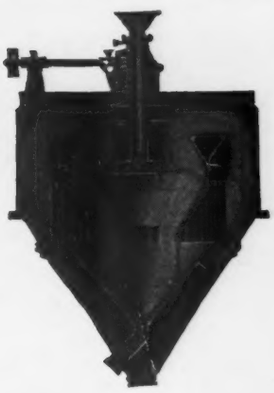
Maxecon Mill



for economical pulverizing

American Filter Air Separator

for fine separating



Perfectecon Screen

for coarse screening

KENT MILL COMPANY

10 Rapelyea Street Brooklyn, N. Y.

A new bulletin of interest to every sand *and* gravel producer

HERE is a concise outline of centrifugal pump types that will be of interest and value to sand and gravel producers, contractors, and other users of centrifugal pumps or hydraulic dredges.

This booklet contains illustrations and brief descriptions of Morris Centrifugal Pumps for handling all grades of abrasive materials, including fine sharp sand, coarse grinding gravel, heavy boulders, and also for general and special services, boiler feed, fire protection, etc.

Each type of Morris Pump shown in this bulletin has been specially designed for its particular operating conditions. The clear water pumps have numerous refinements in design that provide exceptionally high efficiency and long life. The pumps for liquids containing solid materials have particularly large passageways to prevent clogging, and convenient handholes for accessibility to the interior. The pumps for handling sand, gravel and other abrasive materials are unusually rugged in construction with massive wearing parts which may be furnished of special alloys. All Morris Pumps have many unusual features that assure exact suitability for each specific purpose.

The bulletin also illustrates various types of hydraulic dredges for sand and gravel production, municipal improvements, etc.

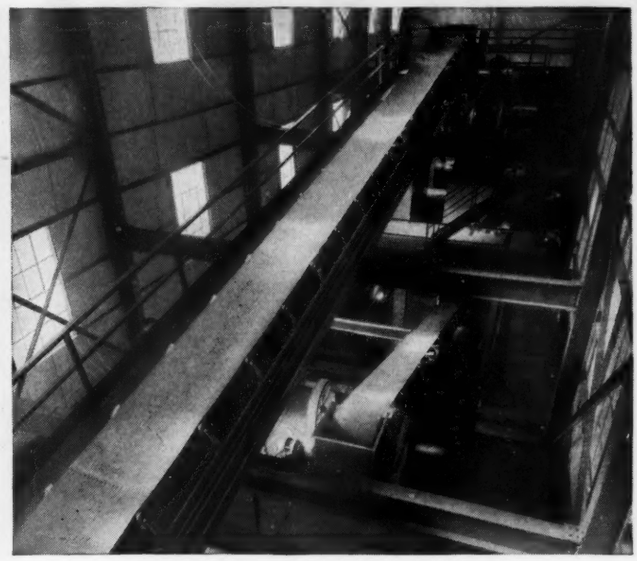
Send the coupon for your copy

Morris Machine Works, Baldwinsville, N. Y.
Export Office: 30 Church Street, New York City
Please send copy of Bulletin 140 to
Name..... Position.....
Company.....
Address.....
RP1232

MORRIS
CENTRIFUGAL PUMPS

All 15 Conveyors

AT HUDSON RIVER STONE ARE COMPLETELY EQUIPPED WITH REX-STEARNS TIMKEN IDLERS



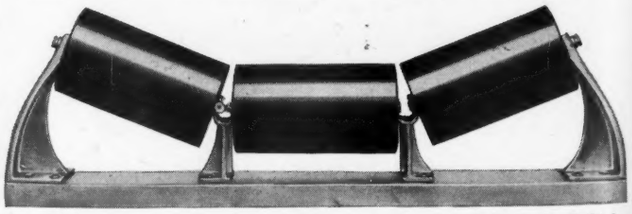
In the Hudson River Stone Corporation plant at Cold Spring, New York—the latest and largest plant in the world producing hard rock concrete aggregate—15 belt conveyors handle the rock through all stages from primary crushing to delivery to the loading docks.

Rex-Stearns Timken Idlers form the roadbed for this 15-Belt rock train—a continuous transportation system for 1000 tons of rock per hour. To insure against non-scheduled stops and to make sure of lowest transportation cost, the Rex-Stearns Timken Idler No. 37 was selected for the job. That is one of the outstanding types of the Rex-Stearns complete line.

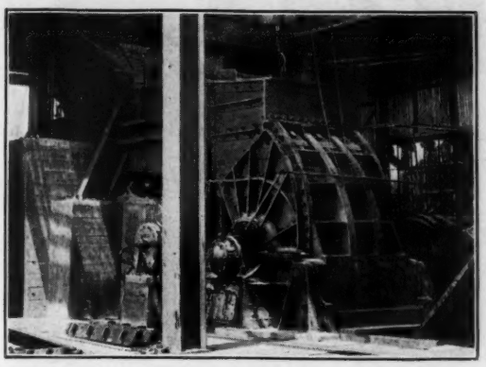
A Chain for Every Drive and Carry

CHAIN BELT COMPANY
MILWAUKEE WEST MILWAUKEE CLEVELAND

CHAIN & BELT CONVEYING



Established 1891—Branches or Representatives in all Principal Cities



The Complete Crushing Equipment of a Modern Cement Plant—A PENN-PRIMARY HAMMERMILL

Saving the Critical Margin

The **PENN-PRIMARY** ***STEELBUILT*** **HAMMERMILL** prepares dry, damp or wet Cement-making materials from Steam Shovel size to proper size for Compartment or Hercules Mill feed, in one dependable operation.

This massive ***STEELBUILT*** Crusher, of the patented Double Reduction type, effects savings in equipment, foundation, building, rehandling and conveying costs, which may easily represent the "critical margin" in your total per barrel cost.

Capacity range to 800 tons hourly, at minimum investment, depreciation, maintenance and power cost.

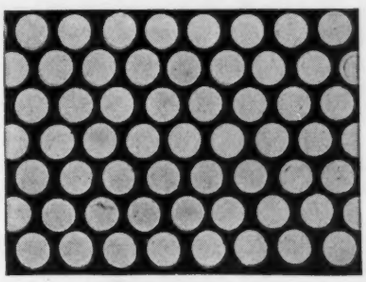
MASSIVE STEEL CONSTRUCTION
POSITIVE TRAMP IRON PROTECTION

Send for PENN-PRIMARY Bulletin 1020 *Our engineers are at your service*

London New York Pittsburgh PENNSYLVANIA CRUSHER COMPANY Chicago Los Angeles Paris

General Offices: **LIBERTY TRUST BUILDING, PHILADELPHIA**

MORROW SCREEN PLATES



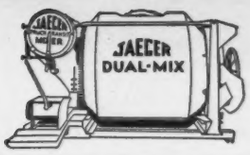
MORROW PERFORATED METAL SCREEN PLATES for sizing and preparing coal, sand, gravel, stone and other bulk materials are made by a Company specializing in screening machinery.

A complete set of punches and dies covering a wide range of sizes, in round, square, oval and diagonal slots are ready for the press, insuring prompt delivery of orders.

Prices are right.
Send for Bulletin 57.

The Morrow Manufacturing Co.
Wellston, Ohio

Are You Going to Establish a COMMERCIAL CONCRETE SERVICE for Your Customers?



WRITE or WIRE for "The Jaeger Story of Super-Concrete" and benefit by the experience of more than 100 operators serving all sizes and types of market. Address

THE JAEGER MACHINE COMPANY
603 Dublin Avenue, Columbus, Ohio
World's Largest Makers of Concrete Mixing Equipment

ALL DOWN THE LINE—

Every last man in your plant can profit by reading ROCK PRODUCTS regularly. It will help him to bring new interest and new efficiency to his job.

Rock Products

With which is incorporated CEMENT and ENGINEERING NEWS Founded 1899

542 South Dearborn Street, Chicago, U.S.A.

See to it that ROCK PRODUCTS reaches you regularly—and pass it around! Subscriptions for the keymen would be mighty good investments.

We produce:

- ☐ Crushed Stone
- ☐ Sand & Gravel
- ☐ Glass Sand
- ☐ Lime
- ☐ Sand-Lime Brick
- ☐ Gypsum
- ☐ Phosphate
- ☐ Cement
- ☐ Slate
- ☐ Talc

Other Materials.....

We retail.....

Date....., 1933

Please enter my subscription to ROCK PRODUCTS for.....year.... (three years $5.00, one year $2.00—please state which. You save a dollar by subscribing for three years), for which we enclose $.....

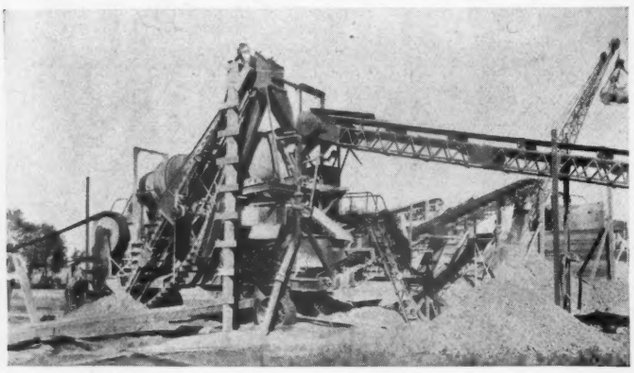
Name.....

Street.....

City.....State.....

Canada, $4.25. Foreign Subscriptions $4.00 a year

. . *Why Did* "PIONEER GRAVEL EQUIPMENT" *Standardize on* ALEMITE?



In a letter of December 1st, 1932, Mr. S. F. Ellertson of the Pioneer Gravel Equipment Manufacturing Company, writes:—

> "All Pioneer equipment is fitted with Alemite fittings for lubrication. Where lubrication is desired on a moving part, flexible tubing is used so that the plant can be lubricated in operation."

Heavy production loads and heavy duty service *demand* modern Alemite High Pressure Lubrication Systems. But *equally important* it is that Genuine Alemite Lubricants be employed in these systems.

Years of research and constant betterment have brought Genuine Alemite Lubricants to the point where you can trust them implicitly to guard your equipment against frictional wear.

Save the 80% (and sometimes more) of breakdowns which follow incorrect, inefficient lubrication. Guard valuable equipment against the expense and delays which follow such breakdowns. Write TODAY for the interesting, profitable Alemite story!

ALEMITE CORPORATION (Division of Stewart-Warner) 673
2688 N. Crawford Avenue, Chicago, Ill.
Gentlemen: I am interested in information leading to the reduction of costs through correct lubrication.

Name_____

Address_____

City_____ State_____

PIONEERS IN SPECIALIZED LUBRICATION

WILLIAMS
"Champion" Buckets
BOOST CRANE OUTPUT

New freedom in handling, super-digging power, unusual speed through reduced cable overhaul, straight cable lead—these are reasons why the Williams "Champion" will increase the daily capacity of any crane and reduce bucket upkeep cost. ***Write for full description.***

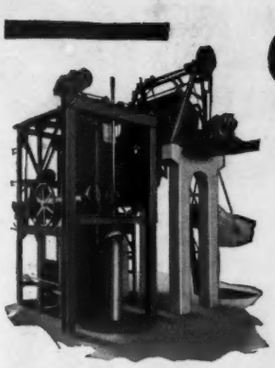
See Williams buckets—power-arm, multiple-rope, and dragline types—at

DETROIT ROAD SHOW
Booths 228-237

Power-Arm, Multiple-Rope, and Dragline Buckets — "Arch-Girder" Trailers

THE WELLMAN ENGINEERING CO.
7008 Central Ave.
CLEVELAND, OHIO

Birmington · New York · Chicago · Detroit · Pittsburgh · Mexico City



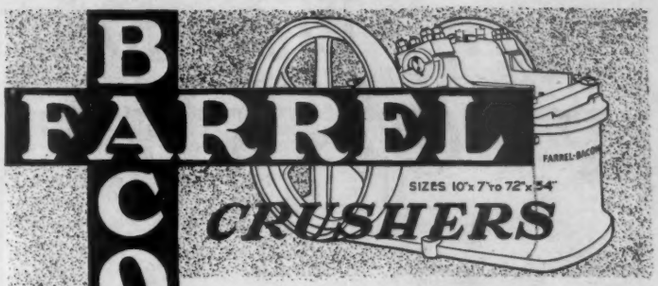
CONCRETE
PIPE
EQUIPMENT

MACHINES
MOLDS

All equipment necessary for the pipe manufacturer

UNIVERSAL CONCRETE PIPE CO.
NEW MARTINSVILLE W. VA.

BACON
FARREL
CRUSHERS



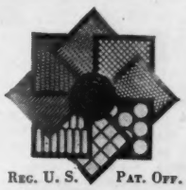
Complete Plants Designed and Equipped.
Screens, Elevators, Conveyors, Quarry, Sand and Gravel Plant Equipment.
Engineering Service.

EARLE C. BACON, Inc.
26 CORTLANDT STREET NEW YORK, N. Y.

EAGLE
EQUIPMENT

Spiral Screw and Log Washers, De-Waterers and Shale Removers, Flume Classifiers, Swintek Ladder Suction Screen Nozzles, Chain Type Cutters, Barges and Pontoons, A Frame and Gantry Hardware, Vibrating and Revolving Screens, Steel Dump Cars, Grizzlies, Car Wheels and Trucks, Steel Bins, Water Tanks, Structural Towers, and Dry Pans.

EAGLE IRON WORKS
Machinists — Founders
DES MOINES, IOWA



Reg. U. S. Pat. Off.

HENDRICK
PERFORATED METALS

and particularly the Heat-Treated, Double-Corrugated Plate are popular in the quarry field. They wear well.
Full range of sizes.

HENDRICK
ELEVATOR BUCKETS

are made to fit. That's the first requisite. Any size or style made. No order too small or too large.

Investigate the Weston Testing Screen for making sizing tests

HENDRICK M'F'G CO., Carbondale, Pa.
Baltimore Birmingham Boston Cincinnati Cleveland
Detroit Hazleton New York Philadelphia Pittsburgh

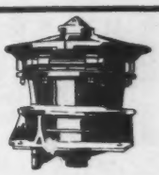
DOUBLE CRIMP LOCK MESHES
NATIONAL SPRING WIRE CLOTH
TRADE MARK

NATIONAL
WIRE CLOTH

In Double and Lock Meshes
Woven from
Genuine Spring Steel Wire
Quick Shipments Attractive Prices

Ask for Catalog

NATIONAL WIRE CLOTH CO.
FOOT OF BELLE STREET
ST. PAUL, MINN.



Complete
Quarry and Gravel Plant
EQUIPMENT
From Crushers to Bin Gates

Write today for Bulletin 266
Smith Engineering Works, 508 E. Capitol Drive, Milwaukee, Wis.

TELSMITH

CUT YOUR CRUSHING COST

MANY an operator is cutting his crushing costs and maintaining production schedules with this most dependable crusher. Simple but sturdy, this efficiently designed crusher represents an exceptionally profitable investment in equipment of this type.

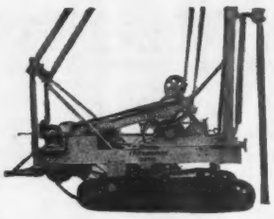
Lewistown Foundry & Machine Company
LEWISTOWN, PENNA.

Perforated Metals — Screens of All Kinds — For Sand, Gravel, Stone, Etc.

MATERIAL IN STOCK
PROMPT SHIPMENT

CHICAGO PERFORATING CO.
2427 to 2445 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

CLIPPER CUTS COST
OF DRILLING



The many inbuilt advantages of the new Loomis "Clipper" size 44—point to bigger profits from drilling jobs. Friction clutch operated full-swing crawlers, extreme ruggedness, simplicity and accessibility combine to save time and cut upkeep and operating cost. It easily climbs unusually steep grades and can be shifted into position in a jiffy. Equipped with steel frame, wooden or steel mast—wire or manila line.

Write for full details

THE LOOMIS MACHINE COMPANY
(Established 1842)
15 E Street - - - Tiffin, Ohio

STEEL
IMMEDIATE SHIPMENT FROM STOCK FOR MAINTENANCE AND REPAIR

When steel is needed in a hurry . . . you can depend upon Ryerson for quick action. Complete stocks of all steel products including bars, plates, sheets, structurals; bolts and nuts, rivets, boiler fittings, chain, etc. Order from the nearest plant. Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON

McLANAHAN PRODUCTS

Single, Double Roll Crushers—Super Dry Pans—Steel Log Washers and Scrubbers—Dryers—Jigs—Screens—Hoists, Elevators and Conveyors—Reciprocating Feeders, Bingates, Chutes, Turn Tables, Elevator Buckets, Car Pullers, Rail Straighteners, Cast Parts, Rough or Finished—Car Wheels and Brake Shoes, Sprockets and Sheaves, Gears and Bearings, Gratings and Columns, Chute Linings, Grate Bars of Special Heat-Resisting Metals.

Write for catalogues listed or for information concerning any of the material, machinery and castings listed, required in mine, quarry or pit.

McLANAHAN & STONE CORPORATION
Manufacturers—Founders—Machinists
Hollidaysburg (Established 1835) Pennsylvania

ELEVATING CONVEYING REDUCTION

All kinds of bulk material including: stone, gravel, sand, cement, lime, gypsum, and similar products are being economically elevated, conveyed, screened, washed, or reduced to any size—by Jeffrey Equipment.

Let our Engineers solve your handling and reduction problems.

The Jeffrey Manufacturing Co.
935-99 North Fourth Street, Columbus, Ohio

JEFFREY
MATERIAL HANDLING EQUIPMENT

MANGANESE STEEL CASTINGS
for the
Rock Products Industry

On Your Next Inquiry Specify
"INDIAN BRAND"
Known For Its Superior Shock and Wear Resisting Qualities.

The Frog, Switch & Mfg. Co.
Established 1881 Carlisle, Pa.

Owen Buckets

GREATER DIGGING POWER
FASTER OPERATION
LONGER LIFE
GUARANTEED AGAINST BREAKAGE
and
"A MOUTHFUL AT EVERY BITE"

THE OWEN BUCKET CO.
6021 BREAKWATER AVENUE - CLEVELAND, OHIO

EVERYTHING IN PERFORATED METAL
All sizes and shapes of holes for screening any product...

The HARRINGTON & KING PERFORATING COMPANY
5650 Fillmore St.
Chicago, Ill.
New York Office:
114 Liberty Street

EASTON CAR AND CONSTRUCTION CO.

Makers of

QUARRY BODIES FOR MOTOR TRUCKS

EASTON, - PENNSYLVANIA

CLASSIFIED ADVERTISEMENTS

USED EQUIPMENT

Shovels or Cranes
FOR SALE

1—Factory rebuilt LIMA 1¼ cu. yd. capacity. This machine can be equipped with either shovel, clamshell, dragline or dragshovel attachments. Very reasonably priced. Carries new machine guarantee. Located at Newark, N. J.

1—Heavy duty ¾ yd. Osgood Steamer, combination shovel and crane. This machine is in A-1 working condition. A real bargain. Located Toledo, Ohio.

1—Koehring ¾ yd. Shovel. Excellent condition throughout. Located Newark, N. J.

1—Erie B Steam Shovel. In excellent condition. Also number of spare parts. Unusual bargain price. Located Brooklyn, N. Y.

1—Northwest ¾ yd. Crane. Very good condition, at low price. Located Brooklyn. N. Y.

1—Complete shovel attachment for Type "O" Thew. Decided bargain.

1—P & H 1¼ yd. combination shovel and crane, equipped with a 45' boom. Good condition throughout. Very cheap. Located Newark, N. J.

We have both Steam and Gasoline Excavators ranging from ½ to 1½ cu. yd. capacity in various parts of the country that will be sold at extremely low prices or leased with leased payments made applying on purchase price.

~

LIMA EXCAVATOR SALES AGENCY

Lima, O., Office:
Lima Trust Bldg.
Tel. Main 4824

Eastern Offices and Warehouse:
317 Frelinghuysen Ave.
Newark, N. J.
Tel.: Waverly 2—0640

Wire or phone nearest office at our expense.

REBUILT BUCKETS
1—Haiss 1-yd. "Hi-Power" type Bucket.
1—Haiss 1-yd. "Contractor" Bucket.
1—Haiss ¾ yd. "Contractor" Bucket.
1—Haiss ¾-yd. "Hi-Power" Bucket.

REBUILT TRUCK LOADERS
1—Haiss Path Digger with Waukesha Engine.

GEORGE HAISS MFG. CO., INC.
140th St. & Rider Ave. New York City

All or part of four complete Stone Crushing and Sand and Gravel Plants; also, two complete Pulverizing Plants, with auxiliary equipment.

A. J. O'NEILL COMPANY
1524 Chestnut St. Philadelphia, Pa.

USED EQUIPMENT

Locomotives All Equipped with ASME Boilers

70-ton 19x24" Porter 6-wheel saddle tank, 200-lbs. steam.
60-ton 18x24" Porter 6-wheel saddle tank, 200-lbs. steam.
50-ton 16x24" American 4-wheel saddle tank, 180-lbs. steam.
40-ton 14x22" American 4-wheel saddle tank, 190-lbs. steam. (2 Duplicates.)
38-ton 14x20" Porter 4-wheel saddle tank, 180-lbs. steam.
28-ton 12x18" Vulcan 4-wheel saddle tank, 190-lbs. steam.
21-ton 11x16" American 4-wheel saddle tank, 180-lbs. steam.
21-ton 11x16" Vulcan 4-wheel saddle tank, 190-lbs. steam, 36" gauge.
70-ton 20x26" Baldwin 6-wheel Switcher with separate tender, 180-lbs. steam.

Our stock also includes many other locomotives, locomotive cranes, shovels, cars, etc. Complete list on request.

Birmingham Rail & Locomotive Co.
Box 391 Birmingham, Ala.

---

1 Yd. Osgood Crawler Shovel, rebuilt.
Side and Center dump cars.
Locomotives—75 ton Switcher, code boiler —saddle tank type, 18 to 65 tons.
Cranes and Draglines, various sizes.

SOUTHERN IRON & EQUIPMENT CO.
Atlanta, Georgia

USED EQUIPMENT WANTED

WANTED

Replacement parts for 12" AMSCO Heaviduty dredge pump, also 12" 45° long radius elbows.

WARD SAND & GRAVEL CO.
Oxford, Michigan

POSITIONS WANTED

SALES AND PROMOTIONAL MAN DESIRES permanent connection with a progressive lime manufacturer. 15 years experience. Well and favorably known among the dealers, contractors and chemical trade in Chicago and Central Illinois. Excellent references as to character and ability. Address Box 555, care of Rock Products, 542 South Dearborn Street, Chicago, Illinois.

POSITION WANTED—EXECUTIVE, AGE 30, married, desires position with crushed stone company. Qualified to take full charge of plant; 700 ton capacity. 8 years experience. Or will lease small plant on royalty basis. Address Box 556, care of Rock Products, 542 South Dearborn Street, Chicago, Illinois.

A RELIABLE MANAGING SUPERINTENDent for lime or crushed stone operation. Can give any desired reference and stand any investigation. Address Box 554, care of Rock Products, 542 South Dearborn Street, Chicago, Illinois.

CONSULTING ENGINEERS

H. J. BROWN
CONSULTING ENGINEER
35 Doane Street, Boston, Massachusetts.
Specializing in Gypsum Plants and in the Mining, Quarrying and Manufacture of Gypsum Products.
Consultation — Design
Examinations — Construction
Reports — Supervision

WE LOOK INTO THE EARTH
By using Diamond Core Drills. We drill for Limestone, Gypsum, Talc, Fire Clay, Coal and all other minerals.
PENNSYLVANIA DRILLING CO.
Drilling Contractors
Pittsburgh, Pa.

Try cloverine fertilizer all crops
H. D. RUHM
Consulting expert on phosphate matters. Correspondence solicited. Will advise as to use of and furnish all brands and grades of phosphates.
In the Mt. Pleasant Phosphate Field
305 West Seventh Street Columbia, Tenn.

MAKE YOUR WANTS KNOWN

ROCK PRODUCTS is the business journal of the rock products industry, its readers are men of influence, and their buying power is big. An advertisement in this classified department will be seen and read. Make your wants known and see how quickly they will be satisfied.

POSITIONS WANTED

Available...
ENGINEER

EXPERIENCED in the rock products industry who can analyze operations and conditions, show the way to a more profitable operation, and carry out such changes as may be indicated.

●

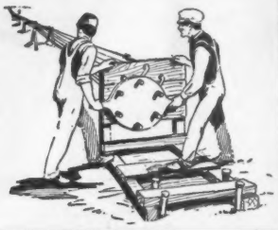
Address Box 551
Care of ROCK PRODUCTS
542 So. Dearborn St. Chicago, Ill.

CONSOLIDATED offers **GOOD USED CRUSHING, PULVERIZING, DRYING AND FILTERING EQUIPMENT—COMPLETE**

Crushing Plants; Diesel, Gasoline, Electric Cranes and Shovels; Hoists; Compressors; Pumps; Dragline and Excavating Equipment; and all sizes and types of Jaw, Gyratory and Roll Crushers; Swing Hammer Mills; Elevators; Belt Conveyors; Rotary and Vibrating Screens; Rotary Kilns and Dryers; Raymond and other fine Pulverizers; Air Separators; Hardinge Ball and Pebble Mills; Silex and iron lined Tube Mills, etc. Send for Bulletin No. 14.

CONSOLIDATED PRODUCTS CO., Inc., 15-16-17 Park Row, New York City
Tel. Barclay 7-0600 **Shops and Yards at Newark, N. J., now covers eight acres**

QUARRY CABLES OF 1876



CHAINS and hemp rope were still in wide use on quarry equipment in 1876 when B & B Ropes were first made—by hand. Gallantly, your industry took a chance on our new, untried products.

NOW, for scores of years, Yellow Strand, the super wire rope, has ***proved*** its stamina, its economy, in quarries everywhere. The whole world affords no finer stock than that from which the wire is drawn. The excellent "staying qualities" of this wire are maintained at the maximum in laying up Flex-Set Preformed Yellow Strand.

Get Catalog 27

BRODERICK & BASCOM ROPE CO.
ST. LOUIS
New York Houston Portland Los Angeles Seattle
FACTORIES: St. Louis and Seattle

Wire for all B&B Ropes undergoes many important laboratory tests before being laid up into rope.

P18

YELLOW STRAND WIRE ROPE

MADE OF WIRE DRAWN TO OUR SPECIFICATIONS FROM HIGHEST QUALITY STOCK

INDEX TO ADVERTISEMENTS

A

Alemite Corporation 100
Allis-Chalmers Mfg. Co. 87
American Steel & Wire Co. 17
Atlas Powder Co. 26

B

Babcock & Wilcox Co. 16
Bacon, Earle C., Inc. 101
Broderick & Bascom Rope Co. 104
Bucyrus-Erie Co. 15

C

Chain Belt Co. 98
Chicago Perforating Co. 101
Classified Advertisements 103
Classified Directory of Advertisers 90-94
Cross Engineering Co. ..... Inside Back Cover

D

De Laval Steam Turbine Co. 21
Dixie Machinery Co. 91
Dorr Company, Inc. 89

E

Eagle Iron Works 101
Easton Car & Construction Co. 102
Ensign-Bickford Co. 30

F

Fairbanks, Morse & Co. 11
Fate-Root-Heath Co. ..... Front Cover
Filtration Engineers, Inc. 22
Frog, Switch & Mfg. Co. 102
Fuller Co. 12

G

General Electric Co. 6
Good Roads Machy. Corp. 13

H

Hardinge Co. 18
Harnischfeger Corporation 23
Harrington & King Perforating Co. 102
Haynes Stellite Co. 7
Hayward Company 24
Hendrick Mfg. Co. 101
Hercules Powder Co., Inc. ..... Inside Back Cover

J

Jaeger Machine Co. 99
Jeffrey Mfg. Co. 102

K

Kent Mill Co. 97

L

Leschen, A., & Sons Rope Co. ..... Inside Back Cover
Lewistown Fdy. & Mach. Co. 101
Lima Locomotive Works 96
Link-Belt Co. 4-5
Loomis Machine Co. 102
Lorain Steel Co. 14

M

McLanahan & Stone Corp. 102
Morris Machine Works 98
Morrow Mfg. Co. 99

N

National Crushed Stone Asso. 93-95
National Wire Cloth Co. 101
National Ready Mixed Concrete Assn. 93-95
National Sand & Gravel Asso. 93-95
Niagara Roller Bearing Screen Co. ..... Inside Front Cover
Nordberg Mfg. Co. 10

O

Ohio Power Shovel Co. 19
Oliver United Filters, Inc. 28-29
Owen Bucket Co. 102

P

Pennsylvania Crusher Co. 99
Plymouth Locomotive Works ..... Front Cover
Productive Equipment Corp. ..... Back Cover

R

Raymond Bros. Impact Pulv. Co. 31
Ross Screen & Feeder Co. 27
Ryerson, Jos. T., & Sons, Inc. 102

S

SKF Industries, Inc. 8
Smidth, F. L., & Co. 32
Smith Engineering Works 101
Sturtevant Mill Co. 20

T

Traylor Eng. & Mfg. Co. 3

U

Universal Concrete Pipe Co. 101
Universal Crusher Co. 97
Universal Vibrating Screen Co. 1
Used Equipment 103

W

Wellman Engineering Co. (G. H. Williams Co.) 100
Wilfley, A. R., & Sons 9
Williamsport Wire Rope Co. 25
Wright, Arthur, & Associates 22

Transportation Library

ANNUAL REVIEW NUMBER

JAN 3 1933
TRANSPORTATION LIBRARY

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Chicago, December 31, 1932 | Issued Every Other Week | Volume XXXV, No. 25

Fuel Cost Less Than 2c Per Car
At the fine new Kansas-Missouri Elevator designed by Edwin Ahlskog for the Missouri-Pacific Railroad at Kansas City, Mo., this Plymouth 30-ton Diesel Locomotive is switching and spotting loaded grain cars, average gross weight 140,000 lbs., to the Car Dumper at a fuel cost of $.018 cents per car.
Dependable, economical haulage was the deciding factor in choosing Plymouth. If you have a haulage problem, put it up to Plymouth.
Write for literature
THE FATE-ROOT-HEATH COMPANY
Plymouth, Ohio
KEEP OFF
PLYMOUTH
Gasoline and Diesel Locomotives

Member of A. B. C. (Audit Bureau of Circulations) and of A. B. P. (Associated Business Papers).
The Oldest Publication and Recognized Authority in This Industry.

Niagara Screens Again Chosen for World's Largest Crushed Stone Plant

NIAGARA Testing Unit

A combination ...ing and rotating u... lab-oratory and g... test purposes. Can be oper-ated with st...tionary, in-termittent or full rotating motion. Adjustable degree of slope.

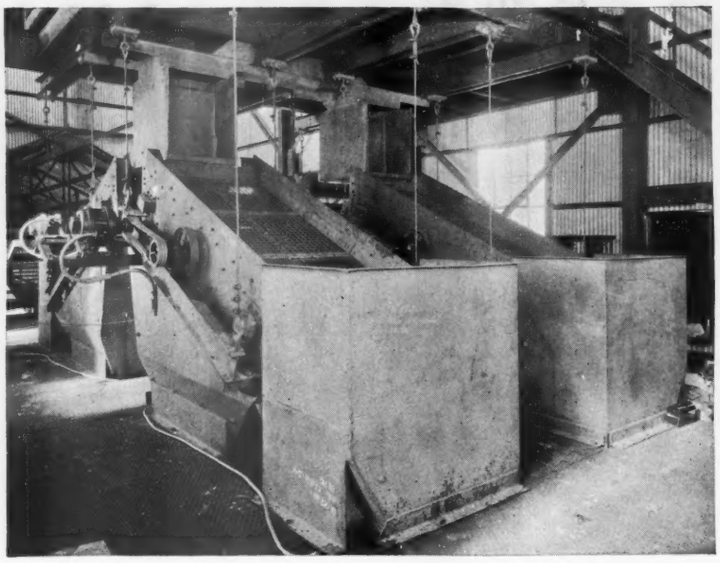
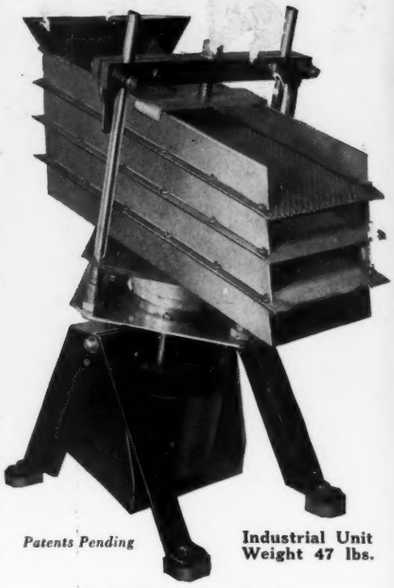


Photo shows four of the 16 Niagara Vibrating Screens in service at new plant of Hudson River Stone Corporation

ALL of the 16 vibrating screens in the gigantic new crushing and sizing plant of the HUDSON RIVER STONE CORPORATION at Cold Spring, New York, are Niagaras; with a total capacity of 7500 cubic yards per day. The experienced engineers who selected equipment for this important plant knew that Niagaras have demonstrated their superiority in every field where screens are used, by increasing capacity, and improving the quality of the finished product. Niagara Superiority is the logical result of correct design.



NIAGARA Industrial Unit

A compact, self-contained screening unit, for moderate operations. Capacity dependent upon size of wire mesh. The ideal equipment for small industrial work up to 325 mesh sizing. Adjustable angle of discharge. ***Both units built on A C or D C current. Ball bearing motor, operated from lighting socket. Light weight, portable. May we demonstrate?***

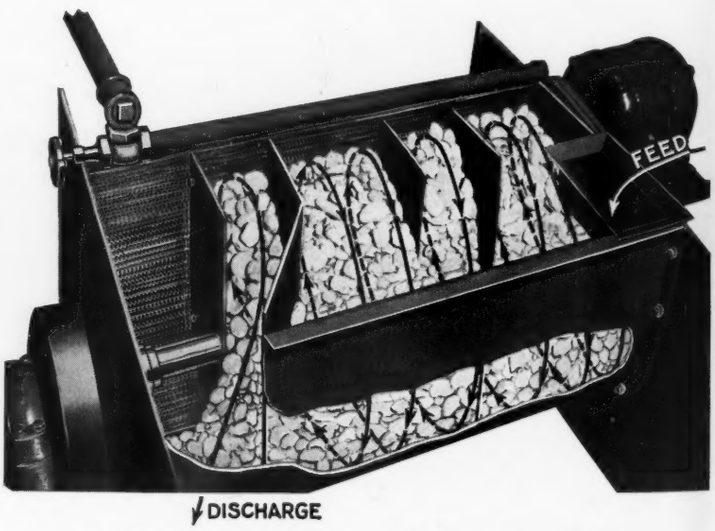
NIAGARA *Leads Again!*

NIAGARA Centrifugal Sand Washer

Removes clay and soft stone from sand and stone.

Exceptional capacity with very low water requirement.

Produces a first-class clean sand from waste stone.



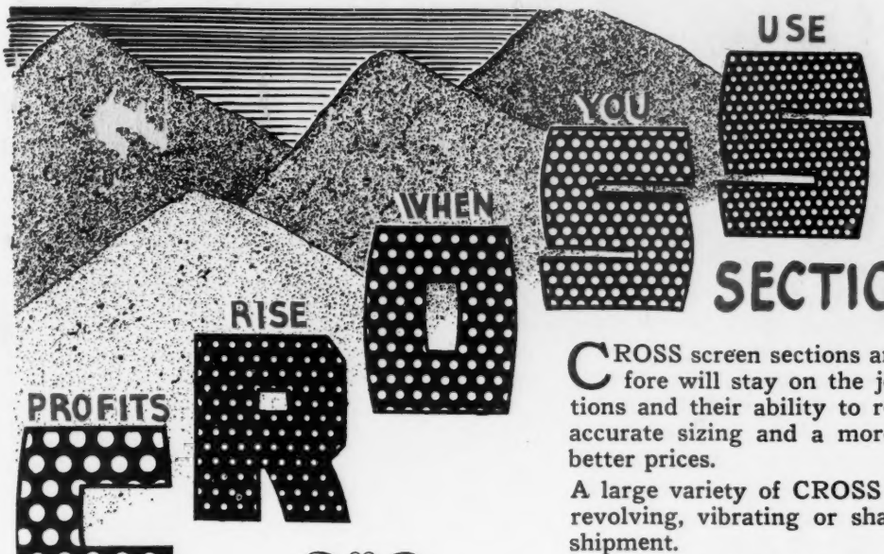
NIAGARA Gyrating Tube Scrubber

An entirely new principle in scrubbing, enormous capacity with very low power consumption—grading and separating may be accomplished while scrubbing. Foreign matter and dirty water are eliminated while scrubbing.

See Our Exhibit at the Joint Exposition, Book-Cadillac Hotel, Detroit, Michigan

NIAGARA ROLLER BEARING SCREEN CO. 40 PEARL STREET BUFFALO, NEW YORK

When writing advertisers, please mention ROCK PRODUCTS



PERFORATED SCREEN SECTIONS AND PLATES

CROSS screen sections and plates will wear longer and therefore will stay on the job longer. The accuracy of perforations and their ability to retain their accuracy results in more accurate sizing and a more desirable product which demands better prices.

A large variety of CROSS perforated metal suitable for either revolving, vibrating or shaker screens is available for instant shipment.

We will be pleased to quote prices on round, square, slots or any design perforations punched from special or ordinary steels to meet individual requirements.

Replace those obsolete screens now with screens of CROSS manufacture. You benefit by our more than 20 years' experience.

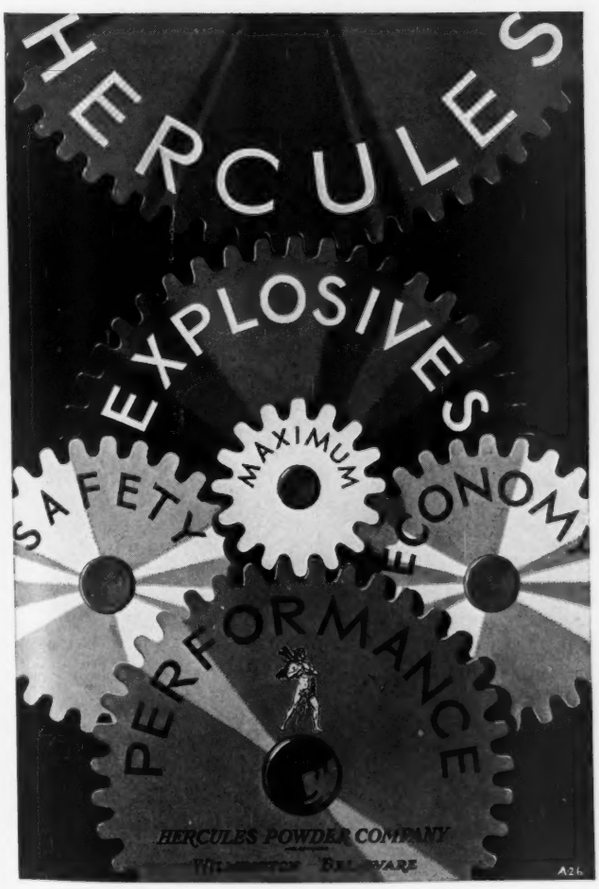
Write for Catalog Today

VISIT
OUR EXHIBIT
DETROIT
CONVENTION

CROSS

CROSS ENGINEERING COMPANY

MANUFACTURING PLANT AND GENERAL OFFICES
CARBONDALE, PENNA.



"HERCULES" WIRE ROPE

THE money saving ability of "HERCULES" (Red-Strand) Wire Rope is in what it can do. Its long life not only keeps its cost "per unit of work" very low, but it also makes rope replacements less frequent.

No one design of wire rope is suitable for all purposes, consequently "HERCULES" (Red-Strand) Wire Rope is furnished in a wide range of constructions, including both Round Strand and Flattened Strand (P.F.S.) types.

Made Only By

A. Leschen & Sons Rope Co.

Established 1857

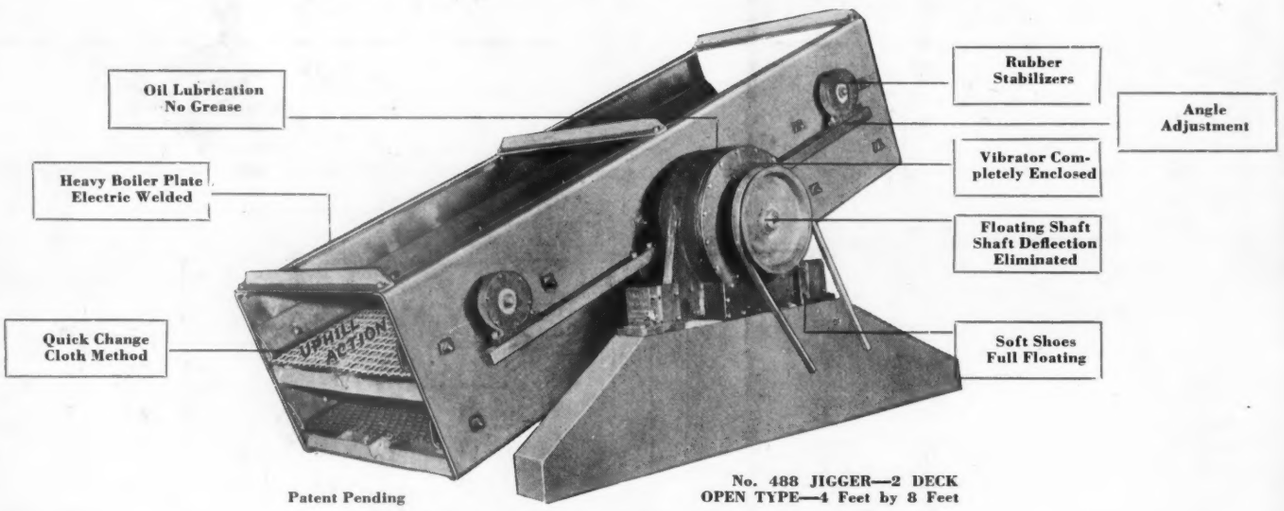
5909 Kennerly Avenue, St. Louis, Mo.

New York Chicago Denver San Francisco

MAKE NO MISTAKE ABOUT THIS!

THE HEAVY DUTY SAFETY JIGGER

Is a Positive Eccentric Vibrating Screen with "Circle throw" Vibration to suit the material • • • counter flow ACTION • • • MASSIVE construction (Electric Welded)



Patent Pending

No. 488 JIGGER—2 DECK
OPEN TYPE—4 Feet by 8 Feet

Priced at 1933 Needs

For Example: JIGGER No. 488—Size 4 feet wide by 8 feet long Double Deck—"V" Pulley Drive

A FEW OF MANY PROMINENT USERS

E. I. DU PONT DE NEMOURS
Parlin, N. J.
SWIFT & COMPANY
New Orleans, La.
CORN PRODUCTS REFINING CO.
Argo, Ill.
MICHIGAN ALKALI CO.
Wyandotte, Mich.
DIAMOND ALKALI CO.
Painesville, Ohio
PITTSBURG PLATE GLASS CO.
(Columbia Chem. Div.)
Barberton, Ohio
UNION CARBIDE CO.
Niagara Falls, N. Y.
A. P. GREEN FIRE BRICK CO.
Mexico, Mo.
GOODYEAR TIRE & RUBBER CO.
Akron, Ohio
WEDRON SILICA CO.
Wedron, Ill.

$920.00

F. O. B. FACTORY

LARGER AND SMALLER SIZES IN 1-2-3 DECKS PROPORTIONATELY LOW

Send for Bulletin No. 732

Productive Equipment Corp.
7535 So. Claremont Ave.
Chicago, Ill.

A FEW OF MANY PROMINENT USERS

ARMOUR & COMPANY
Chicago, Ill.
F. E. SCHUNDLER CO.
Joliet, Ill.
BETHLEHEM STEEL CO.
Bethlehem, Pa.
EVERGREEN MINING CO.
Ironton, Minn.
GENERAL ELECTRIC CO.
Cleveland, Ohio
AMERICAN GYPSUM CO.
Port Clinton, Ohio
BARRETT COMPANY
Depew, N. Y.
PHOSPHATE MINING CO.
Mulberry, Fla.
CONSUMERS CO. (Chicago)
Beloit, Wis.
UNIVERSAL GYPSUM CO.
York, Pa.

SPECIALIZING IN SCREENING OF ALL MATERIALS